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CESTODA.

VOL. II.

BY

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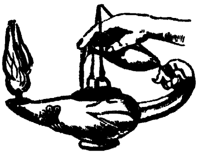

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EXPLANATION OF LETTERING

c., cirrus.
c.m., circular muscle fibres.
c.p., cirrus pouch.
cu., cuticle.
d.e.v., dorsal excretory vessel.
d.v.m., dorso-ventral muscle fibres.
e., eggs.
e.b., excretory bladder.
e.c., egg capsules.
e.v., excretory vessels.
e.v.s., external vesicula seminalis.
f.c., fertilization canal.
f.p., fibrous pad.
i.a., genital atrium.
g.p., genital pore.
g.s., genital sucker.
ip.g., interproglottidal gland.
i.v.s., internal vesicula seminalis.
l., lappets.
l.m., longitudinal muscles.
m.p., medullary parenchyma.
n., nerve.
o., ovary.
o.m., oblique muscle fibres.
ovd., oviduct.
p., parenchyma.
p.g., prostatic glands.
pu.o., paruterine organ.
r.m., retractor muscle.
r.s., receptaculum seminis.
s., spines.
s.c.m., subcuticular muscles.
sg., shell gland.
sph., sphincter.
t., testes.
t.m., transverse muscle fibres.
u., uterus.
u.d., uterine duct.
u.p., uterine pore.
u.r., uterine reticulum.
u.s., uterine sac.
v., vagina.
v.d., vas deferens.
v.e., vasa efferentia.
v.e.v., ventral excretory vessel.
v.g., vitelline gland.
v.s., vesicula seminalis.
vt.d., vitelline duct.
vu., vulva.
v.u.a., vagino-uterine aperture.

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Superfamily VI. **TÆNIOIDEA** Zwicke, 1841.

Synonym :—Order Cyclophyllidea Braun, 1900.

Strobila sometimes composed of a few (three or four), but usually of numerous proglottides (segments). The head bears four muscular cup-shaped suckers (acetabula), which may be armed with spinules. A rostellum, which may or may not carry hooks, is present in some species ; or the head may be lost and a pseudoscolex developed (*Fimbriaria*). External segmentation distinct, except in a few species (*Avitellina*, *Nematotænia*), and corresponding with the internal segmentation. The genital pores are lateral except in the Mesocestoididæ. Each segment may contain one or more sets of genital organs. The testes vary in number from one to several hundreds. Ovary single, usually bilobed ; vitelline gland single, compact, situated behind the ovary except in the Tetrabothriidæ. A vagina is absent in the Acoleidæ, and in the Amabiliidæ it is replaced by an accessory canal. The uterus may consist of a simple sac or it may be replaced by egg-capsules, or by one or more paruterine organs ; uterine pores are absent except in some species of the Tetrabothriidæ, the eggs being liberated as a result of degeneration of the muscular tissue and parenchyma. Gravid segments are passed in the fæces. Larval stage, where known, usually a hollow sphere with one or more invaginations, each of which bears a scolex, or with a bladder containing daughter-bladders, both of which contain numerous scoleces. In some larval forms the bladder is almost absent. Adults in mammals, birds, reptiles, and amphibians.

Key to Families.

1.	Sexes separate, *i. e.*, strobila either male or female........................	**Diœcocestidæ**, nov., [p. 202.
	Sexes united, *i. e.*, strobila contains both male and female organs	2.
2.	Genital pores on ventral (flat) surface of segment	**Mesocestoididæ**, p. 189.
	Genital pores marginal	3.
3.	Vitelline gland anterior to ovary, suckers usually with anterior lappets	**Tetrabothriidæ**, p. 201.
	Vitelline gland posterior to ovary, suckers without anterior lappets	4.
4.	Uterus composed of median stem with lateral branches; eggs with a thick, radially striated embryophore........	**Tæniidæ**, p. 2.
	Uterus sac-like, reticulate, or unstable; eggs with thin embryophores	5.

5.	Head armed with numerous minute hammer-shaped hooks	**Davaineidæ**, p. 69.
	Head not armed with hammer-shaped hooks	6.
6.	Strobila cylindrical, external segmentation incomplete	**Nematotæniidæ**, p. 193.
	Strobila flat, outer segmentation complete with few exceptions	7.
7.	Segments with never more than four testes, genital pores single, unilateral	**Hymenolepididæ**, p. 116.
	Segments with numerous testes, never less than four	8.
8.	Vagina absent, replaced by an accessory duct; rostellum armed	**Amabiliidæ**, p. 194.
	Vagina present (except in *Aporina*)	9.
9.	Vaginal pore absent	**Acoleidæ**, p. 198.
	Vaginal pore present	10.
10.	Head unarmed	**Anoplocephalidæ**, p. 25.
	Head armed (except in *Metroliasthes* and *Rhabdometra*)	11.
11.	Cirrus very large, armed with prominent large spines; worms large and muscular	**Diploposthidæ**, p. 197.
	Cirrus small; when armed, the spines are inconspicuous; worms usually small and fragile	**Dilepididæ**, p. 153.

Family I. TÆNIIDÆ Ludwig, 1886.

Rostellum rarely rudimentary, usually well developed and armed with a double circle of hooks, the hooks in the anterior circle being larger than, and alternating with, those in the posterior circle, rarely with a single circle, or unarmed. Suckers unarmed. Gravid proglottides longer than broad. A single set of reproductive organs in each segment. Genital pores irregularly alternate. Testes numerous. Ovary bilobed, posterior to testes (except in *Cladotænia* and *Catenotænia*). Uterus with a median stem and lateral branches; eggs with a thick, radially striated embryophore (except in *Cladotænia* and *Catenotænia*. Adults in birds and mammals.

Type-genus :—*Tænia* Linnæus, 1758.

Although the genus *Tænia* does not contain a large number of species, it has been subdivided into at least five genera; species with an unarmed head, like *T. saginata*, have been placed in a genus called *Tæniarhynchus* Weinland, 1858, whilst *T. tæniæformis* has been referred to two distinct genera, viz. *Hydatigera* Lam., 1816, and *Reditænia* Sambon, 1924, on account of the fact that its larval form (Cysticercus fasciolaris Rudolphi, 1808) is strobilate.

Hall (1919) divides the genus *Tænia* into three genera, viz. :—

(1) *Tænia* Linnæus, 1758. The rostellum is armed with a double crown of hooks except in (a) *T. saginata*, where the head is unarmed, and (b) *T. monostephanos*, where the head bears a single crown of hooks. Strobila usually large. Larva a

cysticercus (one bladder containing one head). Found in mammals. Type-species :—*Tænia solium* Linnæus, 1758.

(2) *Multiceps* Goeze, 1782. Large worms; rostellum armed with a double crown of hooks. Larval stage a cœnurus (one bladder with many heads). Type-species :—*Multiceps multiceps* (Leske, 1780).

(3) *Echinococcus* Rudolphi, 1801. Strobila small and composed of not more than four or five segments, of which only the posterior (terminal) one is gravid : head with a double crown of hooks ; larval stage an echinococcus. This is a bladder-worm with a thick laminated wall, usually with daughter cysts arising internally or externally. Brood capsules develop in both the parent and the daughter cysts, and contain large numbers of minute scoleces invisible to the naked eye. Adult worms in carnivorous mammals. Larval stage in herbivorous and omnivorous mammals and birds. Type-species :—*Echinococcus granulosus* (Batsch, 1786).

The writer is of opinion that Hall's classification, based as it is on larval characters, is untenable. When a diagnosis is attempted of, for example, a worm passed by a dog, no information is available as to whether the larval form is a cysticercus or a cœnurus. The identification of the worm should be possible on the morphological characters of the adult. Several species can be easily so identified: *T. echinococcus* is distinguished by its minute size ; *T. saginata* by its unarmed head ; *T. monostephanos* by a single crown of hooks ; *T. tæniæformis* by the large size of the hooks, etc. But the greatest difficulty exists in making a diagnosis of most species of *Tænia*, especially those found in dogs. This is due to the fact that characters ascribed to the various species are very variable.

Until recently, only two species of the genus *Tænia* were known which during their development gave rise to a cœnurus, viz., *T. multiceps* Leske, 1780, the larval form of which occurs in the brain of sheep, and *T. serialis* (Gervais, 1847), the larval form of which occurs in the subcutaneous tissues etc. of the rabbit. Certain Italian and German helminthologists were of opinion that these two worms were identical, and that the eggs, when swallowed by rabbits, could only develop in connective tissues, and when swallowed by sheep in the nervous tissues. Baillet (1863), however, proved experimentally that when dogs were fed with the cœnurus from the subcutaneous tissues of a rabbit, and the adult worm obtained, the egg from the adult worm would not infect sheep ; and, similarly, that the eggs from the adult worms derived from a brain cœnurus would not infect rabbits.

Gaiger (1907) recorded a cœnurus from the connective tissues of the goat in India. As the cyst occurred in the connective tissues, and not in the brain, and further, as rabbits do not occur in India, Gaiger concluded that the larva he had found

Principal Characters of

	Number of hooks.	Size of large hooks, μ.	Size of small hooks, μ.	Length of worm, mm.
T. multiceps (Leske, 1790)	22–32	150–170	90–130	400–1000
T. hydatigena Pallas, 1766............	22–44	170–220	110–160	750–5000
T. ovis (Cobbold, 1869)	24–36	156–188	96–128	450–1000
T. solium Linnæus, 1767	25–50	160–180	110–140	2000–8000
T. serialis (Gervais, 1847)	26–32	135–175	78–120	200–720
T. krabbei Moniez, 1879	26–34	148–170	85–120	260
T. tæniæformis (Batsch, 1786)	26–52	380–420	250–270	150–160
T. gaigeri (Hall, 1916)	28–32	160–180	115–150	250–1800
T. balaniceps Hall, 1910..............	28–32	145	93–98	240
T. antarctica Fuhrmann, 1922	28–34	144–156	92–102	250
T. brauni Setti, 1897	30–32	130–140	85–90	100–180
T. regis Baer, 1923	32	290	190	160
T. crassiceps Rudolphi, 1810	32–34	186	135	120–220
T. hyænæ Baer, 1926	32–38	223	127	300
T. retracta Linstow, 1904	34	308	211	550
T. pisiformis (Bloch, 1780)............	34–48	225–294	132–177	600–2000
=? *T. polycalcaria* Linstow, 1903 ...	38	238	158	108
T. infantis Bacigalupo, 1922	35–40	410	260	300
T. laticollis Rudolphi, 1819	38–60	380–420	150–183	50–95
T. omissa Lühe, 1910	40	270–290	90	500–600
T. macrocystis Diesing, 1850	60–74	320–365	180–200	120
T. parva Baer, 1926	44	361	228	55
T. polyacantha Leuckart, 1856	62	58	34	120
T. erythræa Setti, 1897	20	85	95	140–170
T. philippina Garrison, 1907.........	—	—	—	800–1000
T. saginata (Goeze, 1782)	—	—	—	4000–10,000
T. confusa Ward, 1895	—	—	—	5000–8000
T. bremneri Stephens, 1908	—	—	—	?

various Species of Tænia.

Uterine branches.	Eggs, μ.	Host.	Distribution.
9–26	29–37	*Canis fam., C. nebrascensis, Vulpes lagopus.*	Cosmopolitan.
5–10	38–39 : 34–35	*Canis fam., Thous lupus, T. mesomelas.*	Cosmopolitan.
20–25	30–34 : 24–28	*Canis fam.*	Europe, Africa, Australia, U.S.
7–10	31–36	*Homo sapiens.*	Cosmopolitan (sporadic).
20–25	31–34 : 29–30	*Canis fam.*	Europe, Asia, Australia, U.S.
10	?	*Canis fam.*	Iceland, Alaska.
17–18	31–37	*Felis catus, F. maniculata, F. melivora, Catopuma eyra, Uncia concolor, Oncoïdes mitis, O. weidi, O. tigrina, Cervaria uenta, Arctogale ermineus, Mustela foina, M. martes, Putorius putorius.*	Europe, Asia, U.S., S. America.
12–15	25–30	*Canis fam.*	India, Ceylon.
16–17	29–37 : 27–33	*Canis fam., Cervaria rufa.*	U.S.
13–15	20	*Canis fam.*	Antarctic.
10–12	35–38	*Canis fam.*	Erythrea, Italy.
7–10	40	*Uncia leo.*	Sudan.
8	25 : 19	*Vulpes alopex.*	Europe.
12–14	34 : 27	*Hyæna brunea.*	S. Africa.
Immature.	—	*Vulpes ferrilatus.*	Tibet (?).
8–14	37 : 32	*Canis fam., C. nebrascensis, Thous latrans, Felis catus, Uncia tigris, Leopardus pardus, Urocyon cinereo-argenteus.*	Cosmopolitan.
—	—	*Felis pardus.*	Ceylon.
?	35–40	*Homo sapiens.*	S. America.
Immature.	—	*Lynx lynx.*	?
4–5	40	*Uncia concolor, Oncoïdes tigrina.*	S. America.
8–15	34–48 : 25–27	*Cervaria rufa, C. fasciata, Catopuma jaguarandi, Oncoïdes tigrina, O. weidi, Felis macrura, F.* sp., *Galictis* sp.	S. America, U.S.
9–14	27 : 23	*Genetta ludia.*	S. Africa.
8	28 : 22	*Vulpes alopex.*	Europe.
6–14	27 : 28	*Thous mesomelas.*	Abyssinia.
?	35–41 : 26–35	*Homo sapiens.*	Philippines.
15–30	30–40 : 20–30	*Homo sapiens.*	Cosmopolitan.
14–18	39 : 30	*Homo sapiens.*	Texas.
22–24	39 : 30	*Homo sapiens.*	Nigeria.

must be that of *T. serialis*. Dey (1909) recorded the same larval parasite not only from connective and subcutaneous tissues etc., but also from the brain of the goat, in India. Southwell (1912) independently recorded Cœnurus serialis from the goat in Ceylon. The occurrence of the same cœnurus in both the brain and connective tissues etc. of the goat is a very striking fact, because in the rabbit it is extremely rare for a cœnurus to be found in the brain, whilst in the sheep it is rarely found outside the nervous tissue.

Hall (1916) erected a new species of *Tænia*, which he called *Multiceps gaigeri*, for this worm. The adult is found in the dog. So far as the writer is aware, no morphological differences exist between the cœnuri of *T. multiceps* found in the brain of sheep, *T. serialis* from the connective tissues of the rabbit, and *T. gaigeri* found in both the brain and connective tissues of the Indian goat.

The three adult worms which are said to develop from the above cœnuri are so similar that the writer has found it practically impossible to distinguish one from the other, even in cases in which the adult worm has been obtained as a result of feeding experiments, and in which it was definitely known that the cœnurus had been obtained from the brain of a sheep in the one case or the connective tissues of a rabbit in the other.

It will be clear that these three species are very closely related, and it is even possible that they are morphologically identical. Developmentally, *T. multiceps* and *T. serialis* appear to be quite distinct, because in the first case the larvæ are nearly always found in the brain, whilst in the other they are usually found in connective tissues; but the occurrence of a cœnurus in both these positions in the Indian goat justifies the supposition of their possible identity. In this connection it may be noted that the *Ascaris* found in the pig is morphologically identical with the *Ascaris* found in man. Nevertheless, it appears to be impossible to infect man with the larvæ obtained from the pig *Ascaris* or to infect the pig with the larvæ obtained from man.

In view of the fact that worms and their larvæ generally show a predilection for particular sites in the different hosts which they inhabit, it could not be regarded as astonishing if it proved to be a fact that the egg of *T. multiceps* found conditions suitable for its development only in the brain of sheep, or, in the case of rabbits, in the connective tissue, whilst in the goat the conditions were equally suitable in both the above-named sites.

The writer here accepts the genus *Tænia* in its widest application. The species of this genus are so closely related that it is impossible to give a satisfactory differential key, as will be seen from the table on pp. 4 and 5 (after Baer), which gives the principal characters of all known species.

Genus **TÆNIA** Linnæus, 1858.

With the characters of the family.
Type-species :—*Tænia solium* Linnæus, 1758.

(1) **Tænia solium** Linnæus, 1758. (Fig. 222.)

Synonyms numerous, amongst which are the following :—

Tænia cucurbitina Pallas, 1781.
T. pellucida Goeze, 1782.
T. vulgaris Werner, 1782.
T. dentata Gmelin, 1790.
Cysticercus pyriformis (Treutler, 1793).
Halysis solium Zeder, 1800.
T. humana armata Brera, 1802.
C. canis Rudolphi, 1819.
T. armata Pruneyre, 1823.
T. acanthotrias Weinland, 1858.
T. (*Cystotænia*) *solium* R. Leuckart, 1862.
C. suis Cobbold, 1869.

Adult worms in man. Ceylon ; India. (Cosmopolitan.)

Larval form (Cysticercus cellulosæ) in pigs and man. Ceylon; India. (Cosmopolitan.)

As the anatomy of the various species of *Tænia* is very similar, it is proposed to describe the type-species in some detail, and to restrict the descriptions of others to those characters in which they differ amongst themselves.

The worms attain a length of from 2 to 3 m., but may be even longer ; they are composed of from 800 to 900 segments. The gravid ones attain a length of from 1 to 1·2 cm. by 5 to 6 mm. in breadth. The genital pores are irregularly alternate, and are situated near the middle of the lateral margin of the proglottid. The neck varies in length from 5 to 10 mm.

Head. The head is globular and has a diameter of from 600 μ to 1 mm. The rostellum bears a double crown of hooks varying in number from 22 to 32 (usually 26 or 28) ; the large ones have a length of from 160 to 180 μ and alternate irregularly with the small ones, which measure from 110 to 140 μ.

Muscular System. This is well developed, and consists of circular muscles which divide the parenchyma into a cortical and a medullary part. Immediately external to the circular muscles there are a number of longitudinal bundles, the larger of which are situated nearest to the circular fibres ; a second small layer of longitudinal fibres lies just beneath the cuticle. In addition, dorso-ventral muscle fibres are abundant.

Excretory System. This consists of two main vessels running along each lateral margin ; the ventral vessel is larger than the dorsal and is usually situated laterally to it.

Nervous System. A single nerve runs longitudinally throughout the length of the worm along each margin laterally to the excretory vessels ; in addition, two minute nerves, one on each side, situated dorsally and ventrally to the main nerve, can usually be seen.

Male Genitalia. The testes are very numerous and occupy almost the whole of the medullary parenchyma between the excretory vessels. The cirrus sac is comparatively small and reaches the ventral excretory vessel. The cirrus is unarmed ; the vas deferens is tightly coiled and runs from the cirrus sac almost in a straight line to near the middle of the segment.

Female Genitalia. The ovary is bilobed and situated posteriorly, the aporal lobe being slightly larger than the poral. The vagina runs posteriorly to the vas deferens ; near the middle of the segment it curves and passes behind the ovarian isthmus. The vitelline gland is a short and broad gland situated behind the ovary, and it sometimes presents a bilobed appearance ; its duct opens with that of the shell gland into the fertilization canal. The shell gland is a small globular organ situated between the ovarian isthmus and the vitelline gland. The fully developed uterus consists of a median stem with from 7 to 10 lateral compound branches on each side.

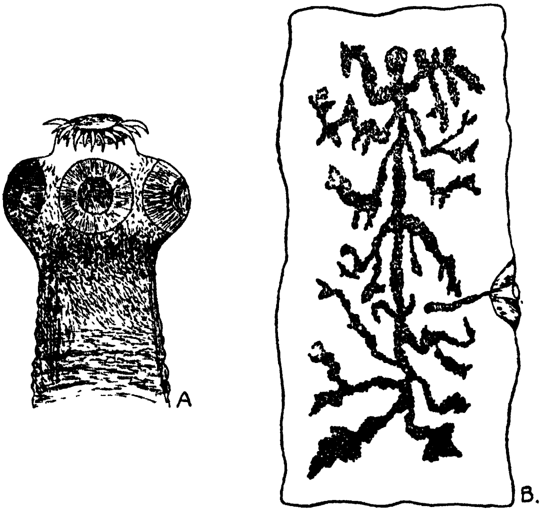


Fig. 222.—*Tænia solium.* A, head, × 30 ; B, gravid segment, × 6. (Original.)

This worm is of very great importance from both a medical and a veterinary point of view. Man becomes infected with the adult worm through eating infected pig's flesh improperly cooked. In addition, if a man swallows the egg as a result of the pollution of water or vegetables it develops into the larval form (Cysticercus cellulosæ). A person harbouring the adult worm may also automatically infect himself with the larval form as a result of unclean habits ; and further, it is stated that in some individuals the presence of the adult worm gives rise to such acute gastric disturbances that gravid segments are regurgitated into the stomach, which is equivalent to thousands of eggs being swallowed. There is no part of the human body from which the larval form has not been recorded. Its presence in the human eye or brain in particular is of very serious importance. Normally, however, the larval form is found in the flesh of the pig, which becomes infected through swallowing eggs which have been passed in human fæces.

C. cellulosæ attains the size of a pea ; it consists of a colourless bladder containing a milky-white spot about the size of a pin's head, this being the head of the future worm. When swallowed by man, the bladder is digested, the head is set free, and attaches itself to the wall of the intestine and buds off a chain of segments.

(2) **Tænia saginata** Goeze, 1782. (Fig. 223.)

Synonyms numerous, amongst which are the following: —

Tænia solium Linnæus, 1758 (*pro parte*).
T. cucurbitina Pallas, 1781 (*pro parte*).
T. inermis Brera, 1802 ; Moquin-Tandon, 1860.
T. lata Pruner, 1847.
Bothriocephalus tropicus Schmidtmüller, 1847.
T. mediocanellata Kuchenmeister, 1855.
T. (*Cystotænia*) *mediocanellata* Leuckart, 1863.

Adult worms in man only ; Ceylon ; India. (Cosmopolitan.)

Larval form (Cysticercus bovis) in cattle only ; Ceylon ; India. (Cosmopolitan.)

This worm is also of considerable medical and veterinary importance, because it is one of the common parasites of man. The larval form occurs in the flesh of cattle.

The worm may attain a length of several metres and a maximum breadth of 6 or 7 mm.; it is composed of about 1000 segments ; the gravid ones measure from 1 to 2 cm. in length by about 7 mm. in breadth. The genital pores are irregularly alternate and situated near the middle of the lateral margin of the segment.

The species is distinguished by the fact that the head does not bear hooks ; it has a diameter of about 1·5 mm. ; the neck is rather long. It resembles *T. solium* very closely, but differs from it in the following points :—

(1) It is larger and more fleshy.
(2) The head is unarmed.

(3) The uterus consists of a central stem with from about 18 to 33 compound lateral branches on each side.

(4) The larval form (C. bovis) occurs only in the flesh of cattle, so that the eggs of this species are not infective to man.

In making a diagnosis of a human infection with a species of *Tænia*, the following points should be noted :—

(1) The eggs of *T. solium* and *T. saginata* cannot be distinguished from each other, so that when eggs are found in the fæces one cannot say to which species they belong.

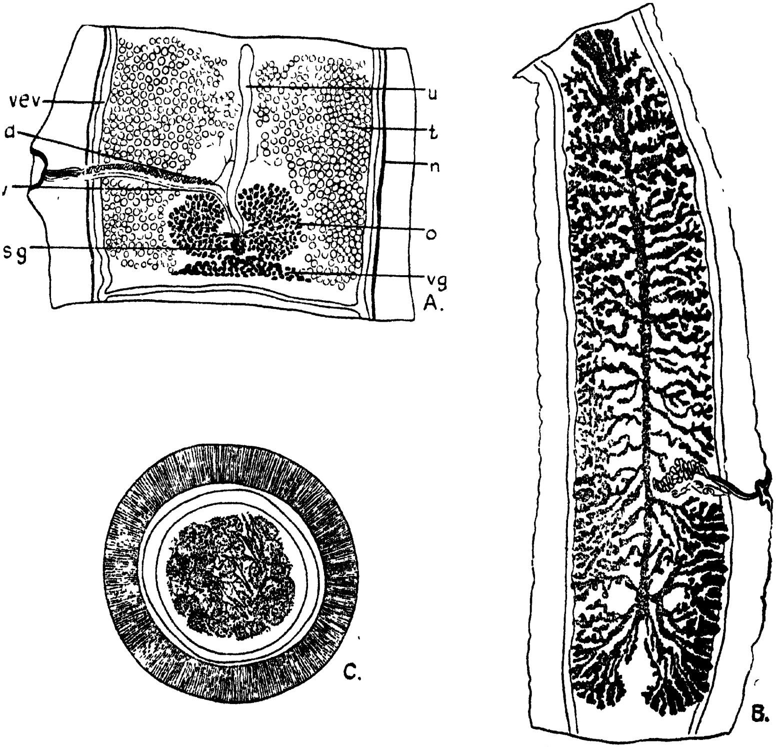


Fig. 223.—*Tænia saginata.* A, mature segment, × 7 ; B, gravid segment, × 8 ; C, *Tænia* egg, × 1000. (Original.)

(2) The head of *T. solium* and its larva is armed with hooks, whilst that of *T. saginata* and its larva is unarmed. A diagnosis can therefore be made easily if the head is available, but it is always difficult to obtain the head, and, from a medical point of view, when the head is obtained the necessity for making a diagnosis has usually passed.

(3) The worms can be identified by the form of the uterus in the gravid segments which are normally passed in human fæces.

In *T. solium* the uterus bears from 8 to 10 branches on each side, whilst in *T. saginata* the number is from about 18 to 33 on each side; in each case the branches are counted as they arise from the main stem. They can be counted easily with a hand-lens if the segments are washed in ordinary fresh water, pressed between two slides, and held up to the light, when the uterine branches show up a milky white.

(3) **Tænia hydatigena** Pallas, 1766.

Synonyms:—*Lumbricus hydropicus* Tyson, 1691.
Hydra hydatula Linnæus, 1767.
Vermis vesicularis eremita Bloch, 1780.
Hydatigena orbicularis Goeze, 1782.
Tænia marginata Batsch, 1786.
Cysticercus tenuicollis Rudolphi, 1810.

From dogs; Lahore. Gaiger; Sondhi.

Larval forms (Cysticercus tenuicollis) in (1) cattle, sheep, and camels. (2) goats; Rangoon. Meggitt. (3) the four-horned antelope (*Tetracercus quadricornis*); Zoological Gardens, Calcutta. Southwell. (4) ? *Cervus axis*; apparently Ceylon. Shipley.

The worm attains a length of from 75 cm. to 5 m., the average size being 2 m., and consists of from 650 to 700 very fleshy segments. Gravid ones measure from 10 to 15 mm. in length and 4 or 5 mm. in breadth. The posterior margin of each segment overlaps the anterior margin of the succeeding one. In the gravid part of the strobila there is a tendency for a median longitudinal furrow to appear on the dorsal and ventral surfaces. It terminates posteriorly in a notch. The genital pores are irregularly alternate, quite inconspicuous, and situated near the middle of the lateral margin of the segment.

Head. The head has a diameter of about 1 mm.; the rostellum is armed with from 26 to 44 hooks, the large ones having a length of from 170 to 220 mm., and the small of from 110 to 160 mm.

Male Genitalia. There are from 600 to 700 rather small testes distributed evenly over the dorsal surface of the segment, but not encroaching on the ovarian and vitelline areas. The vas deferens is loosely coiled and does not bear a seminal vesicle; it runs almost in a straight line from the cirrus sac to the middle of the segment and is often pigmented. The cirrus sac is cylindrical and measures about 450 by 130 μ.

Female Genitalia. The ovary is bilobed, each part being almost circular; the aporal wing is distinctly larger than the poral. The vitelline gland is large and lies transversely behind the ovary. Between the vitelline gland and the ovary the conspicuous shell gland can be seen. From the pore the vagina immediately dilates, and usually has a reflexed loop in the vicinity of the longitudinal excretory vessel; it runs to the middle of the segment and curves round to the mid-ovarian field; it is often pigmented black. The uterus consists of a central stem with from 5 to 10 stout, lateral, multiple branches on each side.

The young larva (Cysticercus tenuicollis) occurs embedded in the liver or free; older forms occur attached to the viscera, and especially to the mesenteries and in the abdominal cavity of oxen, pigs, sheep, etc.

(4) **Tænia echinococcus** (Zeder, 1803) Siebold, 1853. (Fig. 224.)

Synonyms numerous, amongst which are the following:—

Echinococcus granulosus (Batsch, 1786).
E. veterinorum Rudolphi, 1810.
E. polymorphus Diesing, 1850.
Echinococcifer echinococcus (Siebold, 1853) Wienland, 1861.
Tænia echinococca Koeberle, 1861.
T. (*Echinococcifer*) *echinococcus* Leuckart, 1863.
T. (*Arhynchotænia*) *echinococcus* Diesing, 1864.
T. (*Echinococcus*) *echinococcus* Railliet, 1885.

From dogs; Lahore. Gaiger; Sondhi. Berhampur, Bengal. Southwell.

Larval forms (1) in the lungs of cattle; Colombo. Southwell. (2) Horses, cattle, sheep, and camels; India. Gaiger. (3) Elephants; India. Evans; Leece.

The worm measures about 4 mm. in length and its maximum breadth is 500 μ. It is composed of from 3 to 5 segments, the last segment being somewhat longer than the rest of the worm. The first segment contains no genital organs, the second segment is mature, and the third is gravid.

The head bears from 28 to 50 hooks in a double crown, the largest hooks measuring 22 to 30 μ and the small ones from 18 to 22 μ. According to Leuckart, the large hooks measure 40 to 54 μ and the small ones 30 to 38 μ. In the mature segment there are from 40 to 60 testes; the ovary is horse-shoe-shaped with the concavity posterior; in this concavity the vitelline gland lies. The uterus differs from that of other species of *Tænia* in consisting of a tube which is more or less coiled. The larval form is a hydatid cyst found in most herbivorous animals, but principally in cattle. It has been recorded from practically every organ in the body, but shows a predilection for the liver. It also occurs frequently in man.

This worm is of great medical and veterinary importance, not because the presence of the adult worm in the dog gives rise to marked symptoms in that animal, but because the egg, when swallowed by either man or herbivorous animals, gives rise to hydatid disease.

Attention has been called to the fact that the worm is extremely small, measuring only 3 or 4 mm. in length It lies buried in the mucous membrane of the dog's small intestine

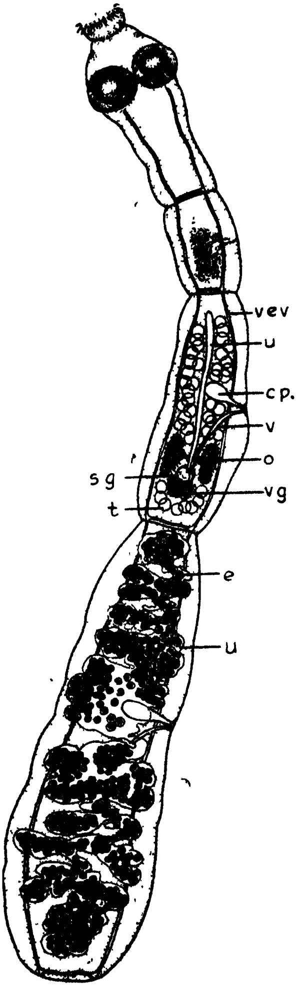


Fig. 224.—*Tænia echinococcus.* Entire worm, × 32. (Original.)

and *post mortem* can only be seen with difficulty, even when looked for by an experienced investigator.

The diagnosis of this worm in the intestine of the dog is a matter of great difficulty. In addition, it should be remarked that several species of *Tænia* occur in the dog, the eggs of which cannot be distinguished one from the other. The diagnosis of *T. echinococcus* in the dog depends on finding the last (gravid) segment in the fæces : to do this it is desirable that the dog's fæces should be mixed with fresh water and emulsified until of the consistency of porridge. Small quantities (about 1 c.c.) are then placed in a black developing dish and mixed with more water ; when present, the last segment of the worm can be seen as a minute body which shows white against the black background. In the opinion of the writer, all dogs suffering from *T. echinococcus* should be destroyed and cremated at once, as they constitute a serious danger to man and domestic animals.

The larval form in cattle is a bladder, often the size of a cricket-ball. Multiple infections, especially in the liver of cattle, are common, and when the infection is extensive the cyst tends to be both smaller and sterile. The cyst is a colourless body full of fluid ; when the fluid is drained off into a dish, a sediment (often referred to as "sand") settles to the bottom. This "sand" consists of an enormous number of heads, each of which, when swallowed by the dog, may become an adult worm in that animal. Sterile cysts are so called because they contain no "sand." Cattle and other herbivorous animals become infected with the hydatid cyst through swallowing eggs which have been deposited on pasture-land in the fæces of infected dogs and foxes.

Man becomes infected with the hydatid cyst in a variety of ways, *e. g.*, pollution of water or green vegetables, or fondling infected animals, as a result of which eggs accidentally gain access to the mouth.

(5) **Tænia pisiformis** (Bloch, 1780) Gmelin, 1790.

Synonyms:—*Vermis vesicularis pisiformis* Bloch, 1780.
Hydatigena pisiformis (Bloch, 1780) Goeze, 1782.
Hydatigena utriculenta Goeze, 1782.
Hydatigena cordata Batsch, 1786.
Hydatigena utricularis Batsch, 1786.
Vesicaria pisiformis (Bloch, 1789) Schrank, 1788.
Tænia serrata canis domestici and *vulpis* Rudolphi, 1793.
Cysticercus pisiformis (Bloch, 1750) Zeder, 1803.
Tænia serrata Goeze, 1782.
Tænia novella Neumann, 1896.
? *Tænia polycalcaria* v. Linstow, 1903.

From (1) Dogs ; Lahore, Punjab. Southwell ; Gaiger. (2) *Canis aureus* ; Museum Compound, Calcutta. Southwell. (3) *Felis tigris* ; Burduar, Nepal Terai ; Sevoke and Sukna, Darjeeling District. Southwell. (4) *Felis leo* ; Zoological Gardens, Calcutta. Southwell. (5) *Felis pardus* ; Wirawila, Antissa, South Ceylon. v. Linstow.

Larval form (Cysticercus pisiformis) apparently not recorded from India.

The worm attains a length of from 60 cm. to 2 m., the average length being from 90 to 100 cm. It is composed of about 400 segments. The maximum breadth is about 5 mm. The terminal gravid segments attain a length of 1 cm. and a breadth of 4 mm. The posterior lateral angles of all the segments are prominent, giving the strobila a serrate appearance. The genital pores are irregularly alternate, not prominent, and located near the middle of the lateral margin of the segment except in gravid ones, where they frequently lie well behind the middle of the lateral margin.

Head. The head has a diameter of 1·3 mm.; the rostellum is very powerful, sometimes 640 μ in diameter, and armed with a double crown of from 34 to 48 strong hooks. The large hooks measure from 225 to 294 μ, there being a strongly curved blade and a long handle. The small hooks measure from 132 to 177 μ in length; they have a strongly curved blade, a bifid guard, and a blunt distal extremity.

Male Genitalia. There are from 400 to 500 testes in each segment, and they occupy all the field between the two excretory vessels except the space occupied by other genital organs. They extend between the two lobes of the ovary and posterior to the vitelline gland. The vasa efferentia open into a distinct seminal vesicle from which the vas deferens arises; this is much coiled, and reaches from the middle of the segment to the cirrus sac. The cirrus sac extends to the ventral excretory vessel and is surrounded by glandular cells.

Female Genitalia. The ovary is bilobed, each lobe being reniform. The vitelline gland is a large, transversely placed organ situated behind the ovary. The shell gland is prominent, and is situated between the ovary and the vitelline gland. The vagina extends from the genital pore to the ovary in the form of a curve, its internal extremity being dilated into a rather prominent receptaculum seminis in the interovarian field. The uterus consists of a central stem with from 8 to 14 lateral compound branches on each side.

Under the name *Tænia polycalcaria* Linstow in 1903 described a worm from the intestine of *Felis pardus* obtained from Wirawila, Antissa, South Ceylon. It had a length of about 108 mm. and a maximum breadth of about 6:71 mm. All the specimens were immature, the reproductive organs being entirely undeveloped. The genital pores were irregularly alternate. The rostellum was armed with 38 hooks disposed in two rows. The large hooks measured about 238 μ in length and the small ones 158 μ. There can be little doubt that this species is identical with *T. pisiformis.*

The larva is a bladder worm (Cysticercus pisiformis) found in the liver, mesenteries, and, free or attached, in the abdominal cavity of rabbits and other rodents.

Tænia sp. Southwell, 1922.

From *Felis tigris*; Zoological Gardens, Calcutta. Southwell, 22. ii. 16.

It is almost certain that this worm is *Tænia pisiformis* (Bloch, 1780) Gmelin, 1790.

(6) **Tænia multiceps** Leske, 1780. (Fig. 225.)

Synonyms:—*Vermis vesicularis socialis* Bloch, 1780.
Tænia vesicularis cerebrina Goeze, 1780.
Hydatigena cerebralis Batsch, 1786.
Vesicaria socialis (Bloch, 1780) Schrank, 1782.
Tænia cerebralis (Batsch, 1786) Gmelin, 1790.
Polycephalus ovinus Zeder, 1803.
Cœnurus cerebralis (Batsch, 1786) Rudolphi, 1808.
Polycephalus cœnurus Tschudi, 1837.
Tænia multiplex Leuckart, 1852.
Tænia cœnurus (Tschudi, 1837) Kuchenmeister, 1853.
Multiceps multiceps (Leske, 1780) Hall, 1910.
Multiplex multiplex (Leuckart, 1852) Liautard in Hall, 1911.

From (1) Dogs; Lahore. Gaiger. (2) The jackal (*Canis aureus*); Zoological Gardens, Calcutta. Southwell. Larval form (Cœnurus cerebralis) in sheep and camels; Lahore. Gaiger. ? (3) *Sus cristatus*, Rangoon, Burma. Meggitt, who obtained "numerous cysticercoids from all parts of the body. The majority of goats are infected." It appears almost certain that the forms recorded from the pig were specimens of Cysticercus cellulosæ, whilst those from goats were specimens of Cysticercus tenuicollis or Cœnurus gaigeri Hall, 1916.

The worm attains a length of from 40 to 100 cm., and consists of from 200 to 250 thin, semitranslucent segments which have a maximum breadth of 5 mm. The last gravid segment measures from 6 to 11 mm. in length and about 4 mm. in breadth. The genital pores are irregularly alternate and are situated slightly behind the middle of the lateral margin of the segment.

Head. The scolex has a diameter of about 800 μ; the rostellum is feebly developed and bears a double crown of from 22 to 32 hooks; the large ones measure from 150 to 170 μ in length; the blade is only slightly curved, the handle straight in general direction but with sinuous borders and commonly notched dorsally. The small hooks measure from 90 to 130 μ in length; the blade is moderately to strongly curved, the handle long and tapering, usually curved, the convexity being dorsal, and the distal extremity is turned dorsally.

Male Genitalia. There are about 200 testes, confined principally to the lateral fields near the longitudinal canal and extending posteriorly to the vitelline glands. The vas deferens is closely coiled, running in the median direction from the cirrus sac to the central stem of the uterus. The cirrus sac extends from the genital sinus to the excretory vessels ; it is sometimes curved, and measures from 315 to 350 μ in length by from 110 to 145 μ in breadth.

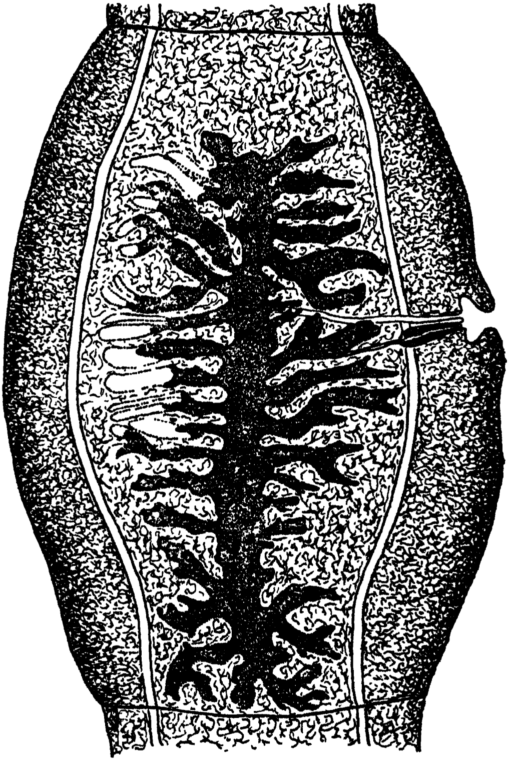


Fig. 225.—*Tænia multiceps.* Gravid segment, × 10. (Original.)

Female Genitalia. The ovary is bilobed, the two halves being rather widely separated, fan-shaped and equal in size. The vitelline gland is small, somewhat triangular, and at some distance posterior to the ovary. The shell gland lies between the vitelline gland and the interovarian field. The vagina possesses no peculiarities. The uterus consists of a central stem with from 9 to 26 lateral compound branches on each side. A striking characteristic of this species is the almost constant interpolation of a uterine branch on each side between the ovary and the vitelline gland.

In *Canis aureus* the worms had a length of 7 cm. and a breadth of 4 mm. The head was armed with two rows of hooks, 15 in each row ; the large ones measured 160 μ and the small 105 μ. The uterus had 16 branches on each side. The genital pores were situated in the middle of the segment.

In specimens from *Felis pardus* mentioned below there were again 15 hooks in each row, the large ones measuring 155 μ and the small ones 116 μ. This is the *Tænia* sp. recorded by Southwell in the Ann. Trop. Med. & Parasitol. 1922.

The larval form is a vesicle as large as a golf ball, filled with fluid, and containing a number of heads (about 150), each of which is easily visible to the naked eye and has a diameter of about 1·5 mm. These heads are peculiar in that they occur in clusters which occupy only a small part of the internal wall of the cyst, the rest of the cyst being clear ; they never become detached from the wall of the cyst. The larva (Cœnurus cerebralis) occurs in the brain of sheep and cattle, and it is rarely found in any other situation.

It will therefore be realized that this worm is of considerable veterinary importance, and when dogs are infected with tapeworms a serious attempt should be made to ascertain whether this species is present or not, because if it is the infected dog is continuously spreading the "gid" disease amongst sheep, goats, and other potential hosts.

Tænia sp. Southwell, 1922.

From *Felis pardus*; Zoological Gardens, Calcutta. Southwell.

The worms measured only 1 cm. in length and 500 μ in breadth; they were quite immature. The large hooks measured 135 to 145 μ and the small hooks 90 to 100 μ.

The writer now refers this species to *Tænia multiceps* Leske, 1780.

(7) **Tænia tæniæformis** (Batsch, 1786) Wolffhügel, 1911.

Synonyms :—*Vermis vesicularis muris* Hartmann, 1695.
Fasciola muris hepaticæ Roederer, 1762.
Tænia hydatigena Pallas, 1766.
Vermis vesicularis tæniæformis Bloch, 1780.
Tænia collo brevissimo Bloch, 1782.
Tænia serrata Goeze, 1782.
Hydatigena tæniæformis Batsch, 1786.
Cysticercus fasciolaris Rudolphi, 1808.
Tænia crassicollis Rudolphi, 1810.
Tænia tæniæformis (Bloch, 1780) Stiles & Stevenson, 1905.

Adult forms in (1) cats; Lahore. Gaiger, Southwell, and Moghe. Rangoon, Burma. Meggitt. (2) *Felis viverrina*; Zoological Gardens, Calcutta. Southwell.

Larval form (Cysticercus fasciolaris) in rats; Berhampur, Bengal; Civil Veterinary College, Calcutta. Southwell.

The worms measure from 50 to 60 cm. in length and have a maximum breadth of from 5 to 6 mm. Only extremely gravid segments are longer than broad. The genital pores are inconspicuous and irregularly alternate; they are situated at the middle of the lateral margin of the segment. The head is stout, cylindrical, and 1·7 mm. thick. The rostellum is armed with a double crown of from 26 to 52 hooks. The large ones measure from 380 to 420 μ in length; the blade is slightly curved and the guard shows a tendency to be bifid. The smaller measure from 250 to 270 μ in length; the blade is moderately curved and the handle is straight with a small distal enlargement.

Male Genitalia. The testes are numerous, closely packed, more or less lateral in position, leaving the central field almost clear; anteriorly, however, they extend across the segment. They also reach posteriorly to the ovary, but do not pass behind the vitelline gland. The vas deferens is closely coiled and extends almost in a straight line from the middle of the segment to the cirrus sac; the latter is slender and frequently curved in gravid segments. In mature segments it measures from 430 to 475 μ and in gravid segments 300 to 345 μ. In whole mounts it is difficult to see.

Female Genitalia. The ovary is bilobed, the poral lobe being smaller than the aporal. The vitelline gland is a somewhat irregular and conspicuous organ situated immediately behind the ovary. The shell gland is very inconspicuous. From the pore the vagina frequently presents a curved dilatation in the vicinity of the excretory vessels, and at this point is encircled by a well developed sphincter. For the rest of its course it runs parallel with the vas deferens to a point near the middle of the segment and then curves between the ovarian lobes. The numerous lateral branches of the uterus (17 or 18 on each side) are almost parallel with each other, but later on become sacculated, especially at their distal extremities.

The larval form, known as Cysticercus fasciolaris, occurs in the body-cavity, liver, etc., of rats and mice. It may attain a length of two or three inches and a breadth of 4 mm. It frequently bears posteriorly a number of segments which, however, do not contain any genital organs.

(8) **Tænia serialis** (Gervais, 1847). (Fig. 226.)

Synonyms:—*Cœnurus serialis* Gervais, 1847.
Tænia serialis (Gervais, 1847) Baillet, 1863.
Cœnurus cuniculi (Diesing, 1863) Cobbold, 1864.
Cœnurus lowzowi Lindemann, 1867.
Multiplex serialis (Gervais, 1864) Liautard, in Hal., 1911.

From dogs; Lahore; Calcutta; and Angul, Orissa. Southwell. Lahore; Gaiger, Sondhi.

Larval form (Cœnurus serialis) not yet recorded.

The larval form of this species normally occurs in the subcutaneous tissues of the rabbit. There are, however, no rabbits in India, although hares are plentiful. Gaiger, Dey, and Southwell separately recorded what thay believed to be larval forms of this species from the connective tissues of the Indian goat, and Dey further recorded it from the brain of that animal. Hall, however, considered that the larval forms recorded from the goat are not *T. serialis*, and he accordingly, in 1916, erected the species *T. gaigeri*, the adult form living in the dog and the larva in the brain and connective tissues of the Indian goat.

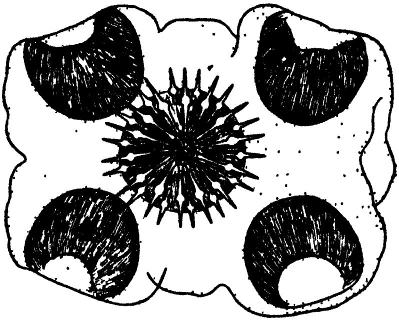


Fig. 226.—*Tænia serialis.* Head, viewed *en face*, × 59. (Original.)

The worm measures from 20 to 72 cm. in length and has a maximum breadth of 3·5 to 5 mm. It is very thick dorsoventrally. The genital pores are prominent and are situated in various positions posterior to the middle of these segments. Mature segments are broader than long, whilst gravid ones are longer than broad and may measure from 6 to 12 mm. in length by 3 to 4 mm. in breadth. According to Hall, the one characteristic of this worm is the fact that the posterior margin of each segment overlaps the anterior margin of the next.

Head. The head is almost spherical and measures from 850 μ to 1·5 mm. in diameter. The rostellum bears from

26 to 32 hooks arranged in a double crown. The large ones vary in length from 135 to 175 μ; the blade is moderately curved and the handle sinuous in outline. The small hooks vary in length from 78 to 120 μ, the blade being strongly to moderately curved; the handle is short and curved and the guard bifid.

Male Genitalia. The testes are very numerous, and at first do not invade the median field. Later, however, they extend into the median field and also occur posteriorly to the ovary. Immediately in front of the ovary there is a small field free from testes. The vas deferens is only slightly coiled. The cirrus sac is narrow and elongated, measuring from 200 to 300 μ in length by from 55 to 100 μ in breadth.

Female Genitalia. The ovary is bilobed; immediately behind it is the somewhat transversely elongated vitelline gland. The shell gland is inconspicuous and is situated between the two lobes of the ovary. From the genital pore the vagina sometimes presents a reflex loop, or several loops, near the longitudinal excretory canal, and then curves gradually on its way to the ovary. The uterus consists of a central stem with from 20 to 25 lateral branches on each side which anastomose; it is therefore difficult to count them.

The larval form is Cœnurus serialis which is found in the subcutaneous tissue and lumbar muscles of rabbits and hares. It is apparently indistinguishable from the cœnurus of *T. multiceps*, which occurs in the brain of sheep.

Tænia ovis (Cobbold, 1869) Ransom, 1913.

Synonyms :—*Cysticercus ovis* Cobbold, 1869.
Cysticercus ovipariens Maddox, 1873.
Cysticercus cellulosæ Kuchenmeister, 1878.
Cysticercus tenuicollis Chatin, 1885.
Cysticercus oviparus Leuckart, 1886.

From dogs; Lahore. Southwell.

Larval forms (Cysticercus ovis) not yet recorded from India.

The worm measures 45 to 110 cm. in length, with a maximum breadth of 6·5 mm.; it shows a tendency to twist in the form of a spiral. The segments have convex lateral borders, and only gravid ones are longer than broad; the latter may attain a length of 1·5 cm. and a breadth of from 3 to 5·5 mm. The genital pores are very prominent and are situated in the middle of the lateral margin of the segment. The pore may attain a diameter of 1 mm. and an elevation of 750 μ.

Head. The scolex is oblong and measures from 800 μ to 1·25 mm. in breadth. The rostellum bears a double crown of from 24 to 36 hooks. The large ones measure from 156 to 188 μ in length; the blade is slightly curved, the handle narrow, rather long, and often with a well marked concavity on its dorsal border near the guard. The small hooks measure from 90 to 100 μ in length ; the blade is sharply curved, the handle long, narrow, and tapering, with a tendency to turn ventrally at its distal extremity.

Male Genitalia. There are about 300 testes, crowded together laterally and pressing on to the lateral margins of the ovary, but not extending posteriorly to it. In the median field they are more loosely scattered, and anteriorly to the ovary they leave a semicircular space. The vas deferens is thrown into a series of somewhat irregular loops, and occasionally a loop crosses the vagina. The cirrus sac measures from 450 to 550 μ in length and does not extend to the ventral excretory vessel.

Female Genitalia. The ovary is bilobed, the aporal half being larger than the poral ; both are of a loose open texture and are elongated transversely. The vitelline gland lies posteriorly to the ovary, is very elongated transversely, and is of a reticular structure. The shell gland is very small. The vagina usually follows a sinuous course, and either just clears the poral lobe of the ovary or crosses it, the latter being, according to Hall, a distinctive character of this species. The uterus consists of a central stem with from 20 to 25 compound lateral branches on each side.

The larva (Cysticercus ovis) is found embedded in the heart, voluntary muscles, œsophagus, lung, etc., of the sheep and goat.

(10) **Tænia retracta** Linstow, 1903.

From *Canis eckloni* (*? Vulpes ferrilatus*), ? Tibet.

Larval form not known.

Doubt exists as to whether the host of this parasite was from Tibet. Linstow states that he obtained the worm from *Canis eckloni* (collection St. Petersburg Museum).

Baer (1925) gives the host as *Vulpes ferrilatus*, the Tibetan fox. The worm was immature and measured 550 mm. in length. The head was armed with 34 hooks arranged in a double crown. The large hooks had a length of 308 μ and the small ones 211 μ. The number of uterine branches and the size of the egg are not known. The species seems closely related to, if not identical with, *T. pisiformis*.

(11) **Tænia gaigeri** (Hall, 1916).

Synonyms :—*Cœnurus seriali*[illegible]vais, 1847.
Multiceps gaige[illegible]l, 1916.

From dogs ; Lahore. Gaiger ; Sondhi.

Larval form (Cœnurus gaigeri) in the connective tissues and brain of Indian goats, recorded by Gaiger, Dey, and Southwell.

The worm varies in length from 25 to 182 cm., the average size being about 40 cm. The terminal segments measure about 14 mm. in length and 2 or 3 mm. in breadth ; it is comparatively thin, delicate, and translucent. The genital pores are inconspicuous, irregularly alternate, and situated slightly behind the middle of the lateral margin of the segment.

Head. The head has a diameter of about 1 mm. The rostellum is poorly developed, measures about 360 μ in breadth, and is armed with a double crown of from 28 to 32 hooks ; the large ones measure from 160 to 180 μ in length ; the blade is slightly curved, the handle nearly straight, with a dorsal notch, and the guard in lateral view is cordiform. The small hooks measure from 115 to 150 μ in length, have a strongly curved blade, and the handle is rather long and straight, tapering to a blunt tip. The guard has a median ventral depression, but is not bifid ; it meets the handle at an obtuse angle. There is a short but distinct neck.

Male Genitalia. There are from 200 to 225 rather large, irregularly spherical testes, confined principally to the lateral fields ; they extend posteriorly as far as the vitelline gland. The vas deferens arises close to the median stem of the uterus and is densely coiled. The cirrus sac measures about 260 μ by from 100 to 125 μ and extends to the ventral excre ory vessel.

Female Genitalia. The vagina is bilobed, each lobe being fan-shaped ; the two lobes are close together. The vitelline gland is somewhat triangular in outline, the apex extends into the inter-ovarian field ; occasionally the gland is elongated, extending along the longitudinal axis of the segment. The shell gland is comparatively large and situated between the two lobes of the ovary. The vagina sometimes shows a reflexed loop near the excretory vessel ; it then pursues a wavy course in a wide curve round the poral ovarian lobe to the mid-ovarian field. The uterus consists of a central stem with from 12 to 15 wide compound branches.

The larval form, Cœnurus gaigeri, is found in the central nervous system, internal organs, intermuscular connective tissue, under the peritoneum and subcutaneous tissues of the goat in India and Ceylon.

The adult worm is a parasite of considerable veterinary importance, and the remarks made with reference to *T. multiceps* apply equally to this species.

Worms incompletely described and of doubtful determination.

(1) **Tænia meander** Linstow, 1903. (Fig. 227.)

From Schneider's leaf-nosed bat (*Hipposideris speoris*), Kalpitiya, Ceylon. ? Willey. Larval form not known.

The worm measures about 1·8 cm. in length and has a maximum breadth, a little behind the middle, of 1·42 mm. All the segments are broader than long and the genital pores are unilateral. The strobila contains no calcareous corpuscles.

The longitudinal muscles are in two layers, the external layer consisting of bundles each containing two or three fibres and the internal bundles each containing from six to eight fibres. There are two longitudinal excretory vessels along each margin, one of which is markedly coiled. The scolex has a breadth of 130 μ, the rostellum of 62 μ; the latter bears, a little distance from its anterior end, a single row of 24 peculiarly shaped minute hooks, each of which measures about 9·1 μ.

The number of testes is not known, but about 20 are visible in each transverse section. The cirrus sac is small and pyriform. The ovary lies in the central substance and consists of a number of groups of glands which spread out mostly on the aporal side. The receptaculum seminis reaches almost to the middle of the transverse section. The vitelline gland is in the middle of the segment and the shell gland is close to it.

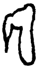


Fig. 227.—*Tænia meander.* Rostellar hook, magnification unknown. (After Linstow.)

The above is an abstract of Linstow's description of this species. The unilateral pores and the single row of small and peculiarly-shaped hooks indicate that it does not belong to the genus *Tænia*; the description is so inadequate that it is impossible to place it in any genus, but the shape of the hooks, which strongly resemble those of *Oligorchis paucitesticulatus* Fuhrmann, 1913, should enable future investigators to identify the worm with considerable certainty.

(2) Tænia sp. Linstow, 1906.

From *Haliaster indus* Bodd.; Nedunkeni, Ceylon. ? Willey.

(3) Tænia sp. Southwell, 1922.

From a dog; Lahore. Southwell.

(4) Tænia sp. Southwell, 1922.

From *Ursus torquatus*; Zoological Gardens, Calcutta. Southwell.

(5) Tænia sp. (cystic form) Meggitt, 1927.

From *Semnopithecus entellus*; Victoria Memorial Park, Rangoon, Burma. Meggitt.

A single cysticercus was obtained. The rostellum was armed with a double crown of alternating large and small hooks, measuring 370 to 400 μ and 260 to 280 μ respectively. The size of the hooks suggests that the species is closely related to *T. tæniæformis* (Batsch, 1786).

Family II. ANOPLOCEPHALIDÆ Cholodkovsky, 1902.

Scolex unarmed, without rostellum or accessory suckers. Segments broader than long. Genital organs single or double in each segment. Genital pores may be absent. Genital ducts generally pass dorsally to the excretory vessels, but may pass between them or ventrally to them. Testes numerous or few. Uterus tubular, reticulate or sac-like ; it may become transformed into egg-capsules, or it may be replaced by one or more paruterine organs. Eggs with three envelopes, the inner one being chitinous and sometimes bearing a pyriform apparatus. Adults in birds, mammals, and reptiles. In no species of this family is the life-history known.

Type-genus :—*Anoplocephala* Blanchard, 1848.

Key to Subfamilies.

Uterus persistent	**Anoplocephalinæ**, p. 25.
Uterus developing paruterine organs	**Thysanosominæ**, p. 49.
Uterus breaks up into egg-capsules	**Linstowinæ**, p. 58.

The family is usually divided into four subfamilies, viz., Anoplocephalinæ Fuhrmann, 1907 ; Linstowinæ Fuhrmann, 1907 ; Thysanosominæ Fuhrmann, 1907 ; and Avitellininæ Gough, 1911. Baer has, however, recently revised the family and has united the latter two subfamilies into one, which he names Thysanosominæ. He therefore recognises three subfamilies only.

Subfamily I. ANOPLOCEPHALINÆ Fuhrmann, 1907.

Genital pores double, unilateral or irregularly alternate, sometimes absent. Genital ducts pass dorsally to excretory vessels except in one case, in which they pass between them. Testes usually numerous, sometimes reduced to two per segment. Cirrus pouch well developed. Female genitalia in the poral half of the segment. Uterus tubular or reticulate, becoming sac-like later on. Adults in mammals and birds.

Type-genus :—*Anoplocephala* Blanchard, 1848.

Of the genera included in this subfamily, the following have been recorded from India :—

(1) *Anoplocephala* Blanchard, 1848 ; (2) *Moniezia* Blanchard, 1891 ; (3) *Cittotænia* Riehm, 1881 ; (4) *Bertiella* Stiles & Hassall, 1902 = *Bertia* Blanchard, 1891 ; (5) *Aporina* Fuhrmann, 1902 ; (6) *Paronia* Diamare, 1900.

Lühe (1910) erected the genus *Paranoplocephala* to accommodate worms resembling species of *Anoplocephala* in all details, except that the genital pores were irregularly alternate instead of unilateral.

Baer (1924) established the genus *Anoplocephaloides*, but the characters of this genus were almost exactly those ascribed to the genus *Anoplocephala*. The same author in 1917 placed his genus *Anoplocephaloides* as a synonym of the genus *Paranoplocephala* Lühe, 1910, but whereas Lühe included in his genus only those species with irregularly alternating pores, Baer emended the characters of Lühe's genus so that it included species with unilateral pores. As emended by Baer it is impossible to say whether a species with unilateral pores should be placed in the genus *Paranoplocephala* or *Anoplocephala*. It is therefore clear that the genus *Paranoplocephala* must be restricted so as to include only those species with irregularly alternating pores.

Key to Genera.

1.	Each segment with a single genital pore ..	2.
	Each segment with two genital pores	3.
2.	Pores unilateral	ANOPLOCEPHALA, p. 26.
	Pores irregularly alternate	4.
3.	Large worms parasitic in sheep and cattle ; eggs with pyriform apparatus	MONIEZIA, p. 37.
	Smaller worms parasitic in rabbits and hares ; eggs with pyriform apparatus....	CITTOTÆNIA, p. 41.
	Parasitic in birds ; eggs without pyriform apparatus	PARONIA, p. 46.
4.	Uterus extending laterally to excretory vessels ; eggs without pyriform apparatus.	APORINA, p. 45.
	Uterus situated internal to the excretory apparatus	BERTIELLA, p. 43.

Genus I. ANOPLOCEPHALA Blanchard, 1848.

A single set of reproductive organs in each proglottis. Genital pores unilateral. Genital canals pass dorsally to longitudinal excretory vessels. Vaginal pore ventral to cirrus sac. Testes aporal or scattered uniformly throughout the proglottis. Female glands poral. Uterus a transversely elongated sac with pocket-like appendages anteriorly and posteriorly. Eggs with well developed pyriform apparatus. Adults in mammals and birds.

Type-species :—*Anoplocephala perfoliata* (Goeze, 1782).

Key to Species.

1.	Parasites of Equidæ	2.
	Parasites of Elephantidæ	*A. manubriata*, p. 36.
	Parasites of Rhinocerotidæ	*A. gigantea*, p. 32.
2.	Head with lappets	*A. perfoliata*, p. 27.
	Head without lappets	3.
3.	Small worms usually less than 2 cm in length	*A. mamillana*, p. 30.
	Large worms up to 15 cm. in length	*A. magna*, p. 30.

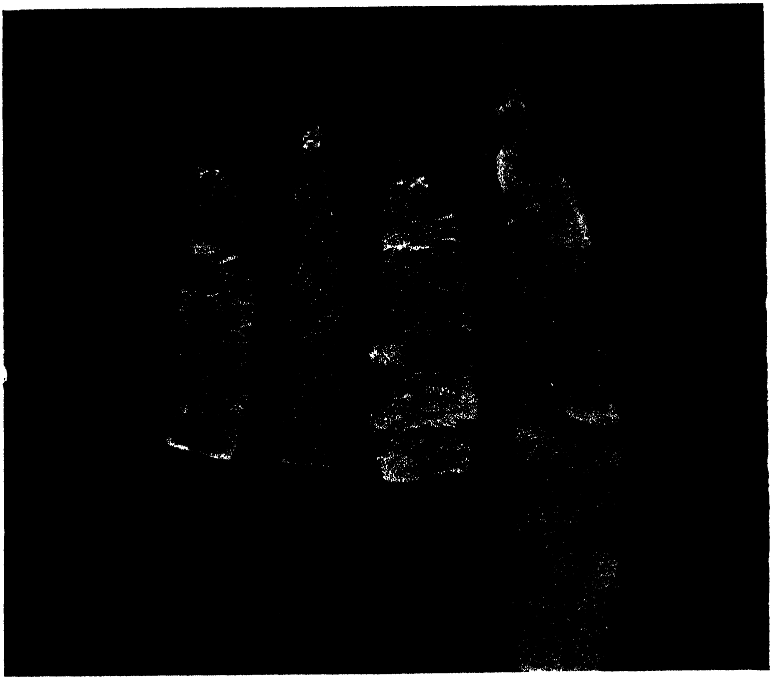


Fig. 228.—*Anoplocephala perfoliata.* Natural size. (After Yorke and Southwell.)

(1) **Anoplocephala perfoliata** (Goeze, 1782). (Figs. 228, 229, 230, 231, & 232 B.)

Synonyms :—*Tænia perfoliata* Goeze, 1782.
Tænia equina Pallas, 1782.
Tænia quadrilobata Abildgaard, 1789.

From the horse; Lahore. Gaiger.

The worm attains a length of 7 cm. and a breadth of 1·2 cm. The scolex is almost cubical and measures 3 mm. in breadth and 2 to 3 mm. dorso-ventrally. The posterior part of the scolex bears four small lappets, two dorsally and two ventrally, situated one behind each sucker.

The longitudinal muscles are well developed, and are arranged in a large number of small bundles, disposed in a single layer. The dorso-ventral and transverse muscles are well developed. The excretory system is much ramified, and consists of two principal longitudinal vessels on each side.

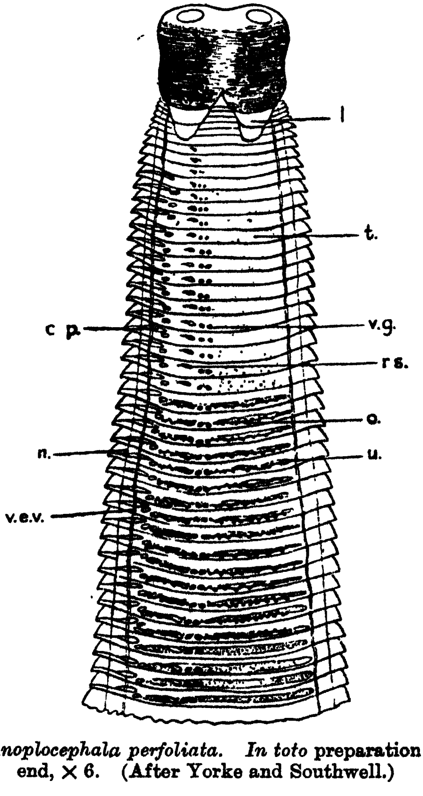
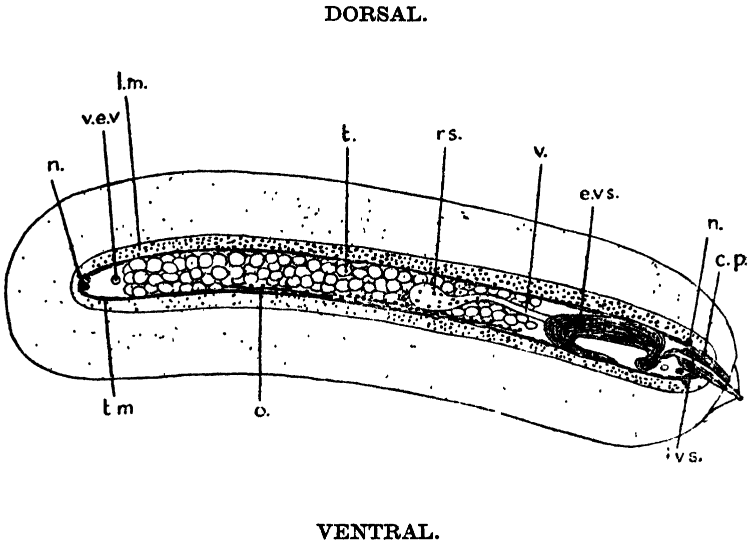
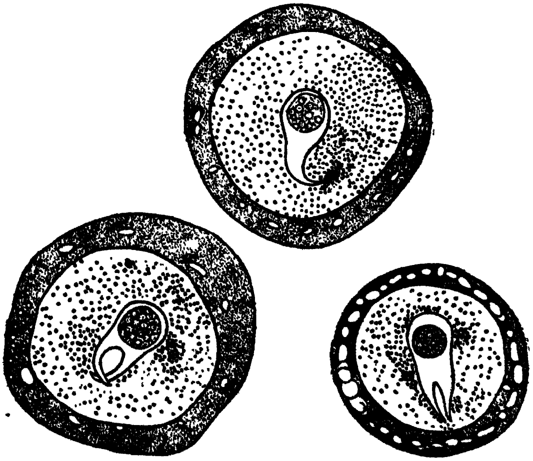


Fig. 229.—*Anoplocephala perfoliata. In toto* preparation of anterior end, × 6. (After Yorke and Southwell.)

Male Genitalia. There are about 200 testes distributed throughout the segment, disposed in two or three dorso-ventral layers. The external seminal vesicle is prominent, and the cirrus sac contains an internal seminal vesicle. The cirrus measures 450 μ in length, 200 μ in breadth, and is armed.

Female Genitalia. The bilobed ovary is situated on the poral side of the segment. The aporal lobe is almost twice as large as the poral lobe. The vitelline gland is situated behind the ovary in the poral half of the segment. The vagina opens behind the cirrus sac and dilates into an enormous receptaculum seminis. The uterus at first is a transverse tube which later on becomes sac-shaped and lobed, and finally fills the whole





Anoplocephala perfoliata.

Fig. 230.—Segment, viewed posteriorly, showing male genitalia, × 15. (After Yorke and Southwell.)

Fig. 231.—Eggs, × 360. (After Yorke and Southwell.)

segment. The egg measures about 80 μ in diameter and the oncosphere 16 μ. It contains a well developed pyriform apparatus.

(2) **Anoplocephala magna** (Abildgaard, 1789). (Fig. 232 B.)

Synonyms :—*Tænia magna* Abildgaard, 1789.
Tænia equi Mueller, 1780 *e. p.*
Tænia equina Pallas, 1781 *e. p.*
Tænia zebræ Rudolphi, 1808.
Tænia plicata Rudolphi, 1810.
Anoplocephala zebræ Railliet, 1891.
Anoplocephala restricta Railliet, 1893.
Anoplocephala plicata var. *pediculata* Railliet, 1893.
Anoplocephala plicata var. *strangulata* Railliet, 1893.
Anoplocephala plicata var. *restricta* Railliet, 1893.
Anoplocephala plicata var. *servei* Bounhiol, 1912.

From the horse and donkey; Lahore and Calcutta. Gaiger and Southwell.

The worm measures up to 25 cm. in length and has a maximum breadth of 2·5 cm. The scolex has a diameter of 3 mm. and appears globular. The suckers have a diameter of 200 μ.

The longitudinal muscles are distributed in three layers and are occasionally segregated into bundles.

The excretory system resembles that of *A. perfoliata.*

There are from 400 to 500 testes filling the entire parenchyma and disposed in three or four dorso-ventral layers. The cirrus pouch is long, but only 100 μ in breadth. It is furnished with a strong retractor muscle. The cirrus is also very long and is armed with spines. Internal and external seminal vesicles are present.

The ovary attains a breadth of 4·5 mm. The vitelline glands and the ovary are in the poral half of the segment. The gravid uterus fills the entire segment. The egg measures 70 to 80 μ and the oncosphere 12 μ. A well developed pyriform apparatus is present.

(3) **Anoplocephala mamillana** (Méhlis, 1831). (Fig. 232 A.)

Synonyms :—*Tænia mamillana* Méhlis, 1831.
Tænia globiceps Diesing, 1856.
Anoplocephala globiceps (Diesing) Lühe, 1895.
Anoplocephaloides mamillana (Méhlis) Baer, 1924.
Paranoplocephala mamillana (Méhlis, 1831) Baer, 1927.

From the horse; Lahore. Gaiger.

Baer (1927) places this species in the genus *Paranoplocephala* Lühe, 1910, the characters of which are :—Worms of varying size. Genital pores unilateral or alternating irregularly. Genital ducts pass dorsally to excretory vessels and nerve. Testes numerous, situated on the aporal side of the ovary, but they may extend beyond the excretory vessels on the same side. Female genital glands situated in the poral half of the segment. Uterus a transverse tube which may extend beyond the excretory vessels on the ventral side, and become sac-like and lobed. Eggs with pyriform apparatus. Adults in rodents and Perissodactyla.

It is difficult to find any justification for placing the species *mamillana* in this genus.

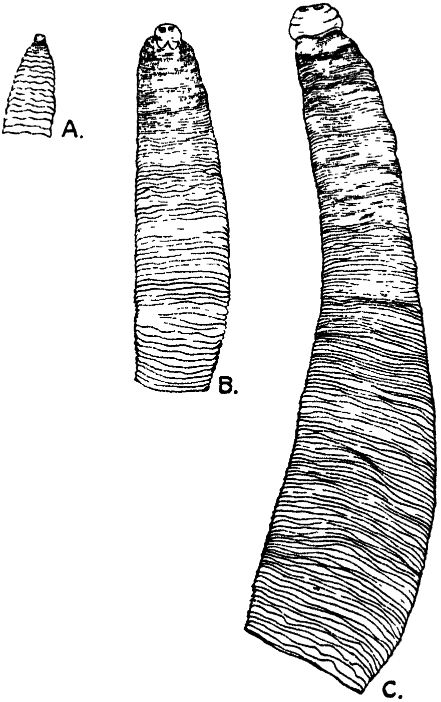


Fig. 232.—Outlines of A, *Anoplocephala mamillana* ; B, *A. perfoliata* ; and C, *A magna*. Natural size. (Original.)

The worm attains a length of from 1 to 4 cm. and a maximum breadth of 6 mm. Usually, however, it is much smaller and measures about 1·2 cm. in length, 3 mm. in maximum breadth, and contains 30 segments. The scolex is from 700 to 800 μ in diameter.

Male Genitalia. There are from 60 to 100 testes disposed in several layers and situated in the aporal half of the segment. Both an internal and external seminal vesicle are present. The cirrus sac is well developed and pyriform, measuring from 800 μ to 1 mm. in length. The cirrus is unarmed.

The female genitalia present no peculiarities. The vagina opens behind and ventrally to the cirrus sac and a large receptaculum seminis is present.

The relative size and appearance of the three preceding species of *Anoplocephala* are represented in fig. 232.

(4) Anoplocephala gigantea (Peters, 1856) Blanchard, 1891. (Fig. 233.)

Synonyms:—*Tænia gigantea* Peters, 1856.
Tænia magna Murie, 1870.
Plagiotænia gigantea (Peters) Peters, 1871.
Anoplocephala gigantea (Peters) Blanchard, 1891.
Anoplocephala latissima Deiner, 1912.
Schizotænia gigantea (Peters) Douthitt, 1915.
Schizotænia latissima (Deiner) Douthitt, 1915.
Anoplocephala vulgaris Southwell, 1921 (*Thysanosoma* sp. Southwell, 1916).
Anoplocephala magna var. *gigantea* (Peters) Baer, 1923.
Plagiotænia latissima (Deiner) Stunkard, 1926.
Plagiotænia vulgaris (Southwell) Stunkard, 1926.
Plagiotænia longa Stunkard, 1926.

From (1) *Rhinoceros unicornis*; Janakpur, Nepal Terai, India. Southwell. (2) *Rhinoceros sondiacus*; locality unknown, specimens in Indian Museum.

This is the broadest cestode known, and apparently is a parasite common in both the African and the Asiatic rhinoceros. Stunkard (1926) re-established the genus *Plagiotænia* based on the large size of this worm, and so separated it from *Anoplocephala* and *Schizotænia*. It is evident that it belongs to the genus in which it is now placed.

The length of the worm is very variable owing to the fragility of its posterior part. It varies from 7 to 15 cm. in length and has a breadth of from 2 to 4 cm.

The MacCallums, however, have recorded a specimen at least 20 feet in length from the Javanese rhinoceros (*R. sondiacus*); whether or not the worm was of this species is not definitely known.

Scolex. The head is usually very small and there are no lappets. The four suckers are directed forward and slightly outward, and have a diameter of about 90 μ; there is no neck. The lateral margins of the anterior segments curve forward so that the head rests in a deep depression between two shoulders, and can be seen only with difficulty with the naked eye.

Muscular System. This is poorly developed; the longitudinal bundles have a thickness of about 50 μ and the annular ones of 15 μ; a single bundle of muscle fibres connects the internal extremity of the cirrus sac to the ventral wall. The dorso-ventral muscle fibres are strongly developed.

Nervous System. There are three longitudinal nerves on each side, the main nerve being median. The other two are small and are situated lateral to the main nerve, one dorsal and one ventral.

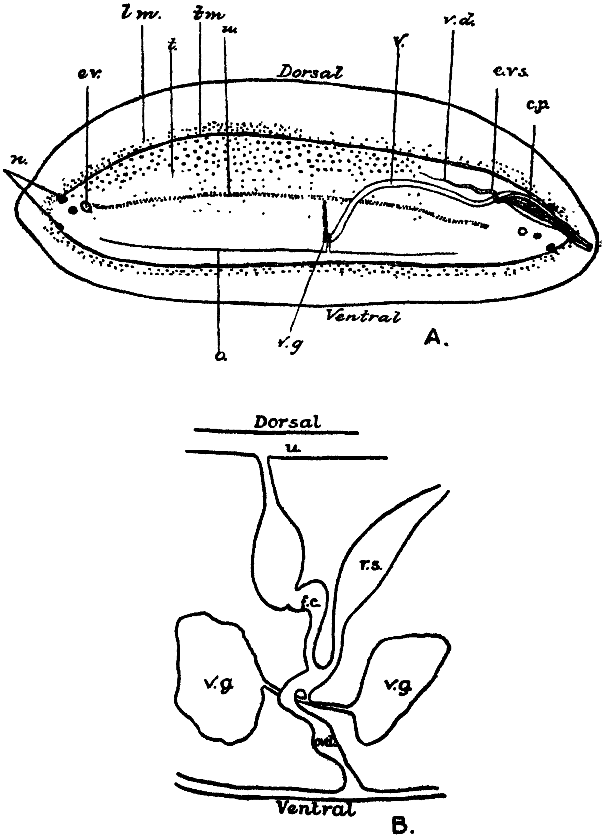


Fig. 233.—*Anoplocephala gigantea.* A, transverse section of immature segment showing development of genitalia, × 21; B, diagram of female ducts. (After Southwell.)

Excretory System. Apparently there is only a single vessel on each side. It is well developed and has a diameter of about 45 μ. It gives off numerous lateral branches.

Male Genitalia. There are from 100 to 200 testes; they first appear in about segment 15, and they disappear in about segment 62. When fully developed they extend the whole distance between the aporal water vessel and the inner extremity of the cirrus sac. They are situated for the most part dorsally but extend ventrally, reaching the rudiment of the ovary.

The cirrus sac is first evident in segment 10, where it measures about 250 μ in length and 150 μ in breadth. The rudimentary external seminal vesicle can also be seen in this segment, lying immediately median to the cirrus sac. A few segments further back the cirrus sac has enlarged to 900 μ in length and its breadth is 275 μ; it lies dorsally to the water vessel and nerve and gradually curves ventrally, until its internal extremity lies almost on the ventral surface. The outer seminal vesicle lies median and dorsally to the cirrus sac; it is a U-shaped tube having a diameter of about 40 μ, the limbs of which lie close together; the inner limb gradually merges into the vas deferens, which narrows and pursues a wavy course along the dorsal surface. The inner seminal vesicle is first visible in segment 26 as a small club-shaped cavity near the internal extremity of the cirrus sac; it enlarges rapidly, and in segment 37 practically fills the entire pouch. The cirrus shortens as the inner seminal vesicle enlarges, and eventually disappears altogether; apparently it is unarmed.

A little further back the cirrus sac measures about 2 mm. in length and has a breadth of 450 μ. It remains this size in a number of segments and then gradually becomes straighter and narrow, persisting to the last segment. The outer seminal vesicle also enlarges enormously, and alters its position accordingly, after which it gradually shrinks.

Female Genitalia. The ovary first appears in segment 19; it is situated ventrally and measures 45 μ in the dorso-ventral diameter. It attains its highest development a little further back, and disappears quickly. When fully developed, it extends laterally to within 650 μ of the aporal water vessel and to within 700 μ of the poral water vessel. The ovary is divided into two wings by the vitelline glands; the poral wing has a lateral diameter of about 2·2 mm. and the aporal of 3·5 mm. The median axis of the ovary is very slightly on the pore side of the segment.

The ovary consists of a series of club-shaped acini arising from a ventral horizontal base; the larger acini measure about 470 μ dorso-ventrally and 60 μ laterally. They decrease in size towards the periphery of the ovary to a slight extent only. In segment 12 the vagina is well defined as a clear irregular tube having a diameter of about 70 μ, and in segment 14 the receptaculum seminis is seen as a slight dilatation of the median extremity of the vagina. Both the vagina and the receptaculum increase in size rapidly, and become enormously distended; in segment 29 the vagina has a diameter of about 450 μ, and the receptaculum fills the whole dorso-ventral area. A few segments further back both these structures atrophy quickly. The vagina has the following relationship to the cirrus sac: from the genital pore it runs inwards, ventrally and posteriorly to the sac, but dorsally to the excretory vessel and nerve; it then crosses posteriorly to the cirrus sac and runs dorsally to it.

In the median direction the receptaculum is continued as a narrow tube, which is joined by the oviduct and continues in a dorsal direction as a long fertilization canal to the uterus. After the vitelline gland and receptaculum seminis are well developed they hide the other structures in the vicinity, but it was noted that the vitelline duct opens near the junction of the oviduct and fertilization canal, posteriorly and ventrally to the receptaculum seminis.

The rudiments of the vitelline gland appear with that of the receptaculum seminis in segment 8, and persist up to segment 100. The gland itself consists of two definite wings separated from each other and presenting a V-shaped appearance. The poral wing is smaller than the aporal wing, the former measuring about 370 by 200 μ and the latter 390 by 390 μ; each is lobulated. Both wings lie on, but do not touch, the ventral surface.

The gland consists in segments 24 to 27 of a thickening on the wall of the fertilization canal which measures about 75 by 55 μ; in posterior segments it appears to be absent.

A rudimentary uterus can be seen in segment 7 or 8. In segment 17 it consists of a very faint cell-string running midway between the dorsal and ventral surfaces. In segment 28 it runs between the ovary and the testes as a straight tube from one water vessel to the other. A little posteriorly it enlarges and its course becomes undulating. In succeeding segments the undulations become more pronounced, and still more posteriorly it presents the appearance of a number of vertical tubes, not always clearly separated from each other ventrally and dorsally, and containing immature eggs. Laterally, the extremities of the uterus remain straight and dilated. In the posterior segments the uterus fills the proglottid entirely, and dorso-ventral and antero-posterior muscular partitions can be seen with great clearness in whole segments or in sections viewed either end on, dorsally or ventrally. No sterile segments were observed.

Eggs. The eggs enlarge and mature gradually in the posterior segments, the pyriform apparatus appearing last. The mature eggs in preserved specimens are of different shapes and sizes, a condition which appears to be dependent on reciprocal pressure in the uterus. Extreme types are either ovoid or cuboid, the latter predominating, but intermediate types occur in abundance. In preserved specimens the following dimensions were obtained :—Size of egg, 77 to 95 μ. Thickness of outer envelope, 16 to 18 μ. Diameter of embryo, 18 to 19 μ. Length of horns of pyriform apparatus, 18 μ. The free egg in the fresh condition is undoubtedly spherical. In immature ones the middle envelope lies close to the outer envelope. As the egg matures, the middle envelope gradually shrinks until it becomes a small mass, about 1 to 2 μ in diameter, attached to the filaments of the pyriform apparatus. Its size, therefore, cannot be given. The eggs contain numerous yolk-particles and granular material. The horns cross each other in very mature eggs, and each horn grows out into a long filament which becomes applied to the outer face of the vitelline envelope.

The segments drop off either singly or in clusters of two three, or four. When single, they assume peculiar shapes.

(5) **Anoplocephala manubriata** Railliet, Henry, & Bouche, 1914.

From *Elephas maximus*; Toungoo, Burma. Meggitt.

This worm has a length of from 1·5 to 2·6 cm. and a maximum breadth of 1·5 cm. Railliet has since obtained fragments which had a breadth of 4 cm., and so one may reasonably assume that the worm attains a much greater length than that given above. The scolex is almost cubical, 6 or 7 mm. in breadth and 5 to 6 mm. dorso-ventrally. The excretory and muscular systems resemble those of *A. perfoliata*. The genital pores are situated in the anterior third of the lateral margin of the segment.

The very numerous testes are situated dorsally in a single layer, and occupy the whole segment between the water vessel. The cirrus sac is from 1·5 to 1·8 mm. in length and about 250 μ in breadth. A large external seminal vesicle is present. The ovary has a breadth of 1·5 mm.; the vitelline gland is compact and situated in the middle of the segment. The vagina opens posterior to the cirrus sac, and is dilated into a rather large receptaculum seminis. The gravid uterus fills the entire segment and is lobulated. The egg contains a pyriform apparatus; it measures from 70 to 80 μ and the oncosphere from 17 to 22 μ.

?**Anoplocephala** sp.

Gaiger (1915) records a worm from a dog in Lahore, which he doubtfully refers to the above genus. It is, however, very improbable that the worm belonged to this genus.

Genus II. MONIEZIA Blanchard, 1891.

A double set of reproductive organs in each proglottis, with two reticulate uteri which may become more or less fused with each other in the median line. Genital ducts pass dorsally to the longitudinal excretory vessels. Interproglottidal glands usually present. Vagina ventral and cirrus dorsal on right side of segment, the reverse on the left. Eggs with well-developed pyriform apparatus, the horns of which generally end in a disc. Adults in mammals.

Type-species :—*Moniezia expansa* (Rudolphi, 1810).

Key to Species.

Interproglottidal glands circular	*M. expansa*, p. 39.
Interproglottidal glands linear	*M. benedeni*, p. 40.

Worms belonging to this genus occur principally in sheep, but they are also found, though less frequently, in the ox. In none of the species is the life-history known, but it is a fact of some significance that the worms occur most frequently and plentifully in lambs, whilst in old sheep they are very much less common. They are long worms measuring from 1 to 2·5 m. in length, having a maximum breadth of over 2 cm., and made up of hundreds of segments. In all the species the head is small and unarmed, and the segments, each of which has two genital pores, one on each lateral margin, are broader than long, except perhaps a few of the most mature. In colour they are creamy-white.

Until quite recently helminthologists distinguished the following species in domestic stock :—*expansa*, *planissima*, *denticulata*, *alba*, *trigonophora*, *nullicollis*, *benedeni*, *neumanni*, and *oblongiceps*. These so-called species were supposed to differ from each other in one or more of the following points :—Size, number, and position of testes, the form and the presence or absence of interproglottidal glands, etc. The species were placed in three groups, viz. :—

(1) Species in which the interproglottidal gland is absent—*alba* group. Including *M. alba* and *M. denticulata*.

(2) Species in which the interproglottidal gland is a linear granulation, situated posteriorly in each segment, and parallel to the posterior margin—*planissima* group. Including *M. planissima*, *M. benedeni*, and *M. neumanni*.

(3) Species in which the interproglottidal gland assumes the form of rings, situated posteriorly in each segment—*expansa* group. Including *M. expansa*, *M. nullicollis*, *M. oblongiceps*, and *M. trigonophora*.

Rudolphi (1804) described, under the name *Tænia denticulata*, a worm from the intestines of cattle. Practically nothing is known regarding the anatomy of this species, and Stiles (1893), after examining a few segments of Rudolphi's original worm, expressed the opinion that "an error had occurred in the label of Rudolphi's specimens, and that they were in reality leporine rather than bovine cestodes." This worm is now the type-species of the genus *Cittotænia*, and Baer (1927) states that it has the following synonymy :—

Tænia denticulata Rudolphi, 1804 ; *T. goezei* Baird, 1853 ; *Cittotænia latissima* Riehm, 1881 ; *Dipilidium latissimum* (Riehm) Riehm, 1881 ; *Moniezia denticulata* (Rudolphi) Blanchard, 1891 ; *M. goezei* (Baird) Blanchard, 1891 ; *M. latissima* (Riehm) Blanchard, 1891 ; *Ctenotænia goezei* (Baird), Railliet, 1893 ; *C. denticulata* (Rudolphi) Stiles & Hassall, 1896 ; *C. denticulata* (Rudolphi) Stiles & Hassall, 1896.

In 1810 Rudolphi, under the same name, described another worm from the intestine of cattle which is believed to differ in certain anatomical details from the species described by him in 1804, but it has not since been recorded. It undoubtedly belongs to the genus *Moniezia*, and appears to differ from other species of this genus in the fact that the genital pores are situated at the extreme posterior edges of the segments. Baer (1927) gives the following synonymy of this species :—

Tænia denticulata Rudolphi, 1810 ; *T. alba* Perroncito, 1879 ; *Moniezia denticulata* (Rudolphi) Blanchard, 1891 ; *M. alba* (Perroncito) Blanchard, 1891 ; *M. alba* var. *dubia* Moniez, 1891 ; *M. amphibia* Linstow, 1901 ; *M. alba* var. *nova* Sauter, 1917 ; *M. alba* var. *longicollis* Sauter, 1917 ; *M. chappuisi* Baer, 1923.

The interproglottidal glands can usually only be seen in stained specimens, and are subject to considerable variation. Recent workers have concluded that in reality there are only two species of *Moniezia* found in sheep and cattle, viz., those in which the interproglottidal glands are linear (sometimes only visible under high magnification), viz., *M. benedeni*, and those in which the glands are in the form of rings, viz., *M. expansa*. In both these species the genital pore is situated in front of the middle of each lateral margin of the segment. In *M. denticulata* Rudolphi, 1810, the genital pore is situated at the extreme posterior edge of the segment on each side. This morphological character is, in the opinion of the writer, sufficient to differentiate this worm from *M. benedeni*, and *M. expansa*, and I accordingly recognize these three species.

Sauter (1917) described a species under the name *M. coniugens* in which the interproglottidal glands were linear in the anterior segments of one strobila and ring-like in the posterior segments of the same worm. Theiler (1924) states that she has "never seen this arrangement, but, as the linear gland is often broken up into several smaller parts, I assume that this is what Sauter saw. . . ." If, however, Sauter's observations were correct, this fourth species could be identified without much difficulty.

(1) **Moniezia expansa** (Rudolphi, 1810). (Fig. 234.)

Synonyms:—*Tænia expansa* Rudolphi, 1810.
Moniezia oblongiceps Stiles & Hassall, 1893.
Moniezia trigonophora Stiles & Hassall, 1893.
Moniezia minima Marotel, 1912.

From (1) Ox and camel; India. Gaiger; Leece. (2) Sheep and goat; India. Gaiger and Southwell. (3) Black-buck (*Antilope cervicapra*); Zoological Gardens, Calcutta. Southwell. (4) Four-horned antilope (*Tetracercus quadricornis*); Zoological Gardens, Calcutta. Southwell. (5) Goat and camel; Burma. Meggitt.

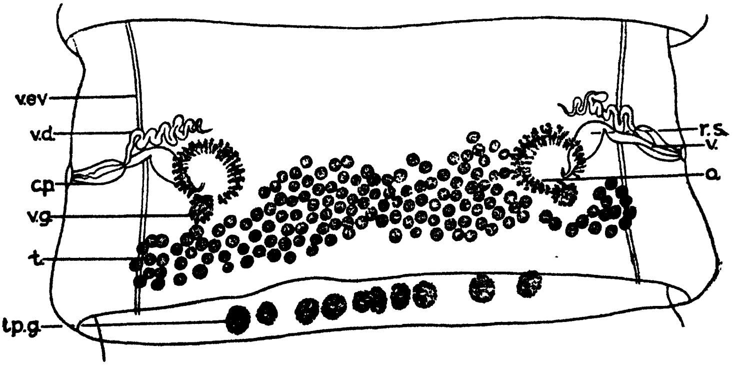


Fig. 234.—*Moniezia expansa*. Mature segment, × 27. (Original.)

The worm attains a length of from 4 to 5 m. and a maximum breadth of 1·6 cm. The segments are practically always broader than long. The interproglottidal glands are grouped around blind sacs situated at the posterior margin of the segment. The number present in each segment varies from 6 or 7 to 30, and occasionally segments may be found in which they are entirely absent.

Muscular System. The circular muscle fibres are scanty and loosely distributed; external to them are the longitudinal muscles, which are well developed and consist of a large number of fibres loosely segregated into bundles, sometimes presenting the appearance of two layers. Laterally the fibres are not evenly distributed. Dorso-ventral fibres are rather numerous, and even conspicuous in some parts of the strobila.

Excretory System. There are two longitudinal vessels on each side, the two ventral vessels being very small.

The genital pores are situated slightly anterior to the middle of the lateral margin of the segment.

Male Genitalia. There are from 300 to 400 testes; their position is subject to considerable variation, but as a rule they occupy about the posterior two-thirds of the segment between the excretory vessels, and they extend in front to the level of the anterior margin of the ovary.

The cirrus sac is a pyriform or fusiform organ having a length of from 50 to 100 μ, which extends to the poral excretory vessels; immediately internal to it the vas deferens is thrown into one or two loose coils. The cirrus is armed.

Female Genitalia. The ovary is bilobed, situated somewhat anterior to the middle of the segment and close to the excretory vessel. Each lobe is prominent and fan-shaped. Immediately behind it is the conspicuous vitelline gland.

The vagina is a curved tube which, close to the ovary, dilates into a large receptaculum seminis.

The uterus is single and reticulate. Dorsally it extends on each side as far as the excretory vessels. The egg measures about 60 μ in diameter and contains a pyriform apparatus.

(2) **Moniezia benedeni** (Moniez, 1879) Blanchard, 1891. (Figs. 235 & 236.)

Synonyms:—*Tænia benedeni* Moniez, 1879.
Moniezia neumanni Moniez, 1891.
Moniezia planissima Stiles & Hassall, 1893.
Moniezia triangularis Marotel, 1912.
Moniezia conjugens Sauter, 1917.
Moniezia crassicollis Sauter, 1917.
Moniezia crassicollis var. *nova* Sauter, 1917.
Moniezia latifrons Sauter, 1917.
Moniezia parva Sauter, 1917.
Moniezia planissima var. *lobata* Sauter, 1917.
Moniezia pellucida Blei, 1920.
Moniezia translucida Jenkins, 1923.

From sheep; Lahore. Southwell.

The worm attains a maximum length of 4 m. and a breadth of 1·6 cm. It is composed of a very large number of segments, the posterior ones being fleshy and having a thickness of about 2 mm. The genital pores are situated in the anterior quarter of the segment. The head has a diameter of about 800 μ and the suckers a diameter of about 3 μ.

There are about 500 testes; in young segments these are sometimes arranged in the form of two triangles. The cirru sac has a length of about 300 μ and a breadth of 100 μ. The female genitalia resemble closely those of *M. expansa*, described above. The egg contains a well-developed pyriform apparatus.

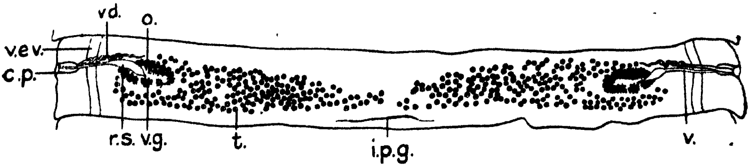


Fig. 235.—*Moniezia benedeni.* Mature segment, × 12. (Original.)

The interproglottidal gland is a narrow linear structure of varying size disposed transversely, close to the posterior margin of the segment.

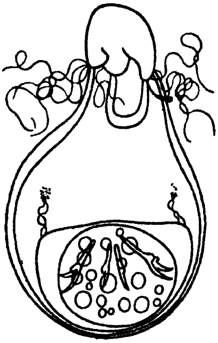


Fig. 236.—Embryophore and hexacanth embryo from a *Moniezia* egg, × 770. (Original.)

Moniezia alba (Perroncito, 1879) Blanchard, 1891.

Southwell (1922) recorded this species from (1) the yak (*Bos grunniens*), Tibet, and (2) sheep, Lahore, Punjab, India. The identity of this parasite is not absolutely certain, but it is undoubtedly either *M. expansa* or *M. benedeni*.

Genus III. CITTOTÆNIA Riehm, 1881.

A double set of reproductive organs in each proglottis. Genital ducts pass dorsally to longitudinal excretory vessels. Testes in an unbroken layer extending across the proglottis. Vagina ventral to cirrus sac on both sides of segment. Uterus single or double (one on each side of median line), trans-

versely elongated, tubular, generally with simple anterior and posterior club-shaped diverticula. Eggs with well-developed pyriform apparatus, the horns of which are long, crossing each other, or occasionally without pyriform apparatus. Adults in mammals and birds.

Type-species :—*Cittotænia denticulata* (Rudolphi, 1804).

Cittotænia pectinata (Goeze, 1782). (Fig. 237.)

Synonyms :—*Tænia pectinata* Goeze, 1782.
Tænia marmotæ Frölich, 1802.
Tænia leporina Rudolphi, 1810.
Dipylidium pectinatum (Goeze) Riehm, 1881.
Moniezia pectinata (Goeze) Blanchard, 1891.
Moniezia marmotæ (Frölich) Blanchard, 1891.
Ctenotænia pectinata (Goeze) Railliet, 1893.
Ctenotænia marmotæ (Frölich) Railliet, 1893.
Ctenotænia perplexa Stiles, 1895.
Ctenotænia variabilis, Stiles, 1895.
Cittotænia marmotæ (Frölich) Stiles & Hassall, 1896.
Cittotænia variabilis (Stiles) Stiles & Hassall, 1896.
Cittotænia variabilis angusta Stiles, 1896.
Cittotænia variabilis imbricata Stiles, 1896.
Cittotænia perplexa (Stiles) Stiles & Hassall, 1896.
Cittotænia quadrata Linstow, 1904.
Cittotænia bursaria Linstow, 1906.
Cittotænia mosaica Hall, 1908.

From (1) *Lepus ruficaudatus*; Songara, Gonda District, United Provinces, India. Southwell. (2) *Lepus nigricollis*; Nedunkeni, Ceylon. Southwell. (3) Hare (*Lepus ? hispidus*); Berhampur, Bengal, India. Southwell.

This worm is extremely variable, as has been noted by Hall, Lymann, and Douthitt, and on this account the synonymy of the worm, as determined by Baer, is very extensive. It measures from 5 to 18 cm. in length and has a maximum breadth of from 1 to 1·5 cm. The genital pores are double in each segment and are situated either near the middle or in the anterior half of the lateral margin of the segment. The scolex varies in diameter from 300 to 800 μ.

The muscular system is well developed. The longitudinal muscles are in two or three layers of bundles. The circular and dorso-ventral fibres are numerous. The excretory system consists of two vessels running along each lateral margin; the ventral vessels anastomose with each other in the anterior part of the segment.

Male Genitalia. There are from 60 to 150 testes, situated in a single dorsal field between and posterior to the two ovaries, and extending between the ovaries and the pores. The cirrus sac is very long, measuring from 400 to 900 μ in length and from 60 to 80 μ in breadth; the cirrus is also long and unarmed.

The vas deferens is thrown into coils ; inside the sac it dilates into an internal seminal vesicle.

Female Genitalia. The ovary is somewhat fan-shaped and has a diameter of from 600 to 650 μ. The vitelline gland lies immediately posterior to the ovary and has a diameter of about 200 μ. The uterus is single and consists at first of a transverse tube situated in front of the testes and extending laterally as far as the excretory vessels on the dorsal surface ; later on it becomes sac-shaped and lobed. The egg measures from 50 to 60 μ in diameter and contains a well-developed pyriform apparatus.

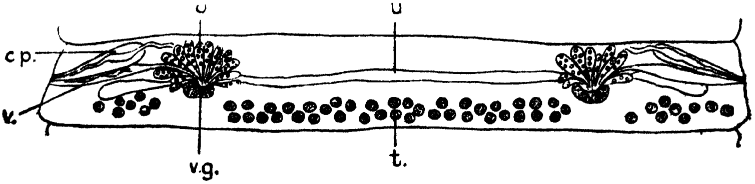


Fig. 237.—*Cittotænia pectinata.* Mature segment, magnification unknown. (After Baer.)

Cittotænia avicola Fuhrmann, 1897.

Southwell recorded this species from *Lophophorus refulgens*, Zoological Gardens, Calcutta, and Meggitt doubtfully referred to the same species a worm which he obtained from Somett's jungle-fowl, Victoria Memorial Park, Rangoon. Southwell has re-examined his specimens, and after prolonged search with the oil-immersion lens, discovered a rostellum with innumerable hooks, each about 9 μ in length, very deeply retracted within the head. There can be no doubt that the worms are specimens of *Cotugnia margareta* Beddard, 1916, and it appears possible that Meggitt's worm from the jungle-fowl may also be the same species.

Genus IV. BERTIELLA Stiles & Hassall, 1902.

Worms of medium size, with a globular scolex. Genital pores irregularly alternate. Genital ducts pass dorsally to excretory vessels and nerve. Testes numerous, forming a continuous field limited by the excretory vessels. Cirrus sac slightly developed and containing a seminal vesicle. Ovary and vitelline gland situated in poral half of the segment. Vagina surrounded by a layer of glandular cells. Uterus a transverse sac situated between the excretory vessels. Eggs with a pyriform apparatus. Adults in primates.

Type-species :—*Bertiella studeri* (Blanchard, 1891.)

Bertiella studeri (Blanchard, 1891) Stiles & Hassall, 1902. (Fig. 238.)

Synonyms:—*Bertia studeri* Blanchard, 1891.
Bertia satyri Blanchard, 1891.
Tænia (Bertia) conferta Meyner, 1895.
Bertiella studeri (Blanchard, 1891) Stiles & Hassall, 1902.
Bertiella satyri (Blanchard, 1891) Stiles & Hassall, 1902.
Bertiella conferta (Meyner, 1895) Stiles & Hassall, 1902.
Bertia polyorchis Linstow, 1905.
Bertiella cercopitheci Beddard, 1911.

From (1) *Simia satyrus*; Zoological Gardens, Calcutta. Southwell. (2) *Hylobates hoolock*, Zoological Gardens, Calcutta. Chandler.

The worm varies in length up to 80 cm., but the average is from 25 to 35 cm., with a breadth of 1·5 cm. The scolex measures from 300 to 700 μ in diameter.

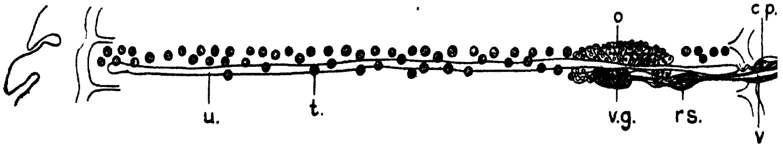


Fig. 238.—*Bertiella studeri*. Mature segment, magnification unknown. (After Baer.)

The longitudinal musculature is composed of four layers of fibres disposed in small concentric bundles each containing from 25 to 30 fibres. The dorso-ventral and transverse muscles are well developed. The musculature varies widely in different worms and also in different regions of the same worm. There are four longitudinal excretory vessels; the ventral ones are larger than the dorsal, and are united by a rather prominent transverse vessel in the posterior part of the segment. On each side of the segment there is a main nerve and two accessory nerves. The genital ducts pass dorsally to the excretory vessels and nerve.

Male Genitalia. There are from 150 to 300 testes in one or two layers occupying the whole width of the segment. Each testis measures from 60 to 100 μ. The vas deferens pursues a straight course before opening into the cirrus sac; this measures 400 to 600 μ in length and just reaches to the ventral vessel; it contains a vesicula seminalis. The cirrus is armed.

Female Genitalia. The ovary is contracted, lobed, and situated in the poral half of the segment. It measures from

200 to 600 μ in breadth. The vitelline gland is small, kidney-shaped, and lies posteriorly and dorsally to the ovary. The vagina opens posteriorly and ventrally to the cirrus sac. It is surrounded throughout its length by a layer of glandular cells which are more developed in the distal region of the vagina. There is a large receptaculum seminis. The uterus at first appears as a transverse tube situated between the excretory vessels; when fully developed it fills the entire segment. The egg has a diameter of from 45 to 60 μ and the oncosphere of from 10 to 16 μ; the pyriform apparatus is well developed and its horns terminate in long filaments.

Genus V. **APORINA** Fuhrmann, 1903.

Worms of medium size. The genital pores, when present, are irregularly alternate; in some species they only occur in young segments, whilst in other species they are absent altogether. Genital ducts pass dorsally to excretory vessels and nerve. Cirrus sac small and slightly developed. Testes numerous, surrounding the female genitalia. The latter are situated in the poral half of the segment. Uterus a transverse tube which extends beyond the excretory vessels, and may bear diverticula; it later on becomes sac-like and lobed. Eggs without pyriform apparatus. Adults in birds.

Type-species:—*Aporina alba* Fuhrmann, 1902.

Aporina delafondi (Railliet, 1892) Baer, 1927. (Fig. 239.)

Synonyms:—*Tænia sphenocephala* (Rudolphi) Mégnin, 1891, *ex parte.*
Tænia delafondi Railliet, 1892.
Bertia delafondi (Railliet) Fuhrmann, 1891.
Bertiella delafondi (Railliet) Stiles & Hassall, 1902.

From (1) pigeons (*Columba* sp.); Kasauli, India. Korke. (2) *Platycercus pennanti*; Zoological Gardens, Calcutta. Southwell.

This species has a length of 14 cm. and a maximum breadth of 5 mm. The scolex has a diameter of 220 μ. The longitudinal muscles are composed of numerous small bundles which fill the cortical parenchyma. The transverse muscles are well developed and the dorso-ventral fibres are rather thick. The genital pores are irregularly alternate and open in the anterior third of the lateral margin of the segment.

There are about 100 testes, situated around the female genitalia, there being more on the aporal than on the poral side. The vas deferens opens into an external seminal vesicle before entering the cirrus sac; the latter is rather small and does not reach the excretory vessels on the poral side; it measures only 80 μ in length and contains a rather large internal seminal vesicle. The cirrus is armed.

The ovary and the vitelline gland are situated in the poral half of the segment. The vagina lies posterior to the cirrus sac and opens into a rather large receptaculum seminis. The uterus is a transverse tube which later on, as it fills with eggs, becomes saccular and lobed. The egg has a diameter of 42 μ.

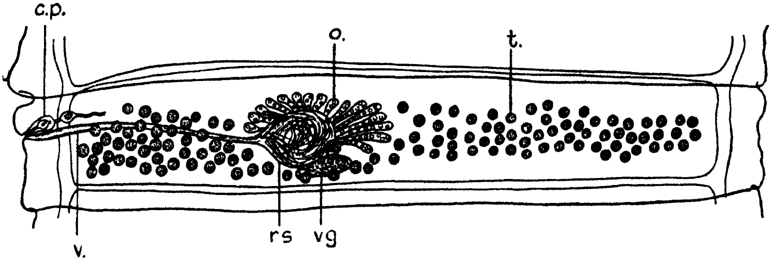


Fig. 239.—*Aporina delafondi*. Mature segment, magnification unknown. (After Baer.)

Genus VI. PARONIA Diamare, 1900.

Worms of medium size. Genital pores double. Two sets of genital organs in each segment. Genital ducts pass dorsally to the excretory vessels and the nerve. Vagina usually ventral to the cirrus pouch on both sides, but it is sometimes ventral on one side and dorsal on the other. Testes very numerous, forming a single dorsal and continuous field which sometimes extends beyond the excretory vessels. Uterus at first double, each horseshoe-shaped, later on developing numerous diverticula and becoming a single uterus. Eggs without pyriform apparatus. Adults in birds.

Type-species :—*Paronia carrinoi* Diamare, 1900.

Linstow in 1888 obtained a worm from *Trichoglossus swainsoni* (Australia) which he named *Tænia trichoglossi*. His description was very imperfect, and he did not even state that the genital pores were double.

Diamare (1900) erected the genus *Paronia* to accommodate a double-pored cestode found in the Australian parrot *Cyclopsittacus suavissimus*. The type-species was *P. carrinoi*. As Diamare's description was considered somewhat inadequate, Fuhrmann in 1901 placed the genus *Paronia* as a synonym of *Moniezia*, and at the same time he noted that *T. trichoglossi* Linstow, 1888, was identical with the *P. carrinoi* Diamare. Nevertheless Fuhrmann considered *T. trichoglossi* as a *nomen nudum*; apparently the type-species of the genus should be *P. trichoglossi* (Linstow, 1888).

In 1902, under the name of *Moniezia columbæ*, Fuhrmann described a worm found in *Ptilonopus* sp. and *Columba* sp. In 1918 he re-established Diamare's genus *Paronia* and referred the latter species to the genus *Paronia*. It differs from *P. carrinoi* in minute details only.

Paronia columbæ (Fuhrmann, 1902) Fuhrmann, 1918. (Figs. 240 & 241.)

Synonyms :—*Paronia carrinoi* Diamare, 1900, *ex parte*.
Moniezia columbæ Fuhrmann, 1912.

From pigeons (*Columba* sp.) ; Berhampur, Bengal. Southwell.

Specimens which are gravid, but without heads, have a length of about 5 cm. and a maximum breadth of 3 mm. Some of the posterior segments are a little longer than broad. The genital pores are double and are situated near the middle of the lateral margin of the segment.

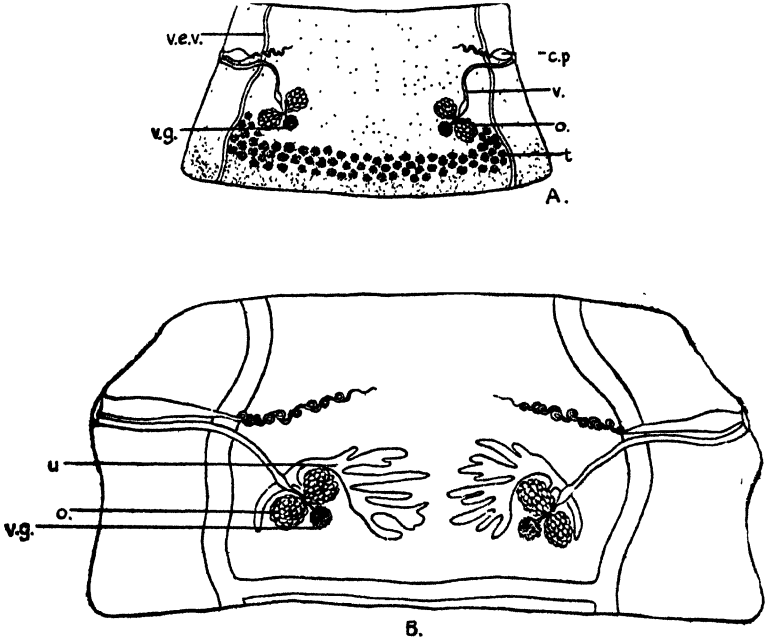


Fig. 240.—*Paronia columbæ*. A, mature segment, × 27; B, segment showing developing uterus, × 53. (Original.)

The muscular system consists of two small layers of bundles, the inner one being the larger. The circular fibres are not well developed, but are disposed in three layers, viz., one internal, one external to the longitudinal muscles, and the third small layer between the inner and the outer longitudinal muscle bundles.

The excretory system consists of two longitudinal vessels on each side, the dorsal one being small and situated laterally to the larger ventral vessel. The latter vessels communicate with each other by a wide transverse branch situated in the posterior part of each segment.

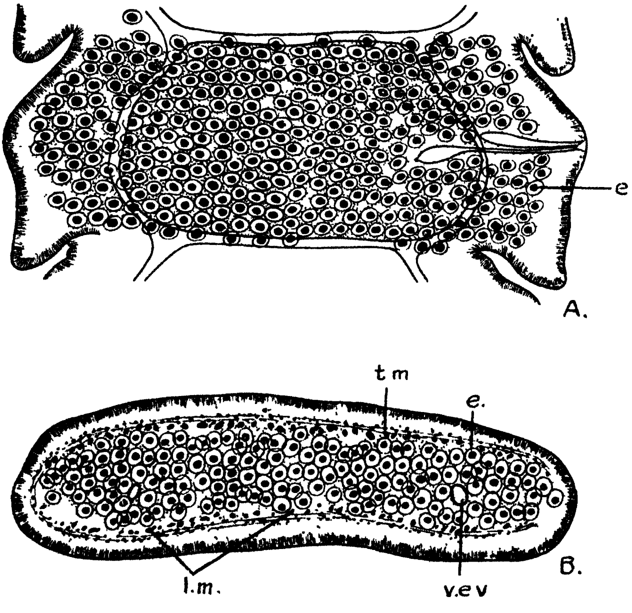


Fig. 241.—*Paronia columbæ.* A, horizontal section of gravid segment, × 30 B, transverse section of gravid segment, × 30. (Original.)

The testes are numerous (over 100) and are situated in the posterior half of the segment; they extend laterally as far as the ovary and ventral excretory vessel. The cirrus sac is anterior to the vagina and extends slightly internally to the ventral excretory vessel. The vas deferens is very short and strongly coiled.

The ovary is fan-shaped and consists of a number of tubular follicles; immediately posterior to it is a conspicuous vitelline gland. The vagina runs posterior to the cirrus sac; just anterior to the ovary it dilates into a conspicuous receptaculum seminis. The uterus is at first double in each segment; it arises as a semicircular tube surrounding the ovary anteriorly on each side of the segment; from it numerous compound tubular outgrowths arise extending in the median direction; these enlarge and fuse with the outgrowths from the opposite side, the walls disappear, and eventually the uterus occupies the entire segment, extending laterally to the water vessels on each side. The egg has a diameter of about 75 μ and the oncospheres one of 25 μ; a pyriform apparatus is absent.

Subfamily II. THYSANOSOMINÆ Fuhrmann, 1907.

Large worms. Genital pores double or single; in the latter case they are irregularly alternate. Genital canals dorsal to excretory vessels, or between them. Testes very numerous or few, in a single field or in two lateral groups. Female genitalia in poral half of segment. Vitelline gland may be absent, in which case the ovary contains the nutritive cells. Uterus tubular; may be very long and undulating. The paruterine organs may be very numerous or single. They each contain several eggs. Adults in ruminants.

Type-genus:—*Thysanosoma* Diesing, 1835.

It has already been noted that Baer has reunited the two subfamilies Thysanosominæ and Avitellininæ, the characters of which are given above. The subfamily contains the following genera:—(1) *Thysanosoma* Diesing, 1835; (2) *Stilesia* Railliet, 1893; (3) *Avitellina* Gough, 1911; (4) *Thysaniezia* Skrjabin, 1926=*Helictometra* Baer, 1927; (5) *Ascotænia* Baer, 1927.

Key to Genera.

1. With a double set of genital organs in each segment	THYSANOSOMA, p. 50.
With a single set of genital organs in each segment	2.
2. With one paruterine organ in each segment.	AVITELLINA, p. 53.
With two paruterine organs in each segment.	STILESIA, p. 50.

No species referable to the genera *Ascotænia* and *Thysaniezia* have been recorded from India, and doubt exists regarding a species referred by Southwell to the genus *Thysanosoma*.

Genus I. **THYSANOSOMA** Diesing, 1835.

Worms of medium size. Posterior edges of segment fimbriated. Two sets of genitalia in each segment. Genital canals between excretory vessels and dorsally to nerve. Testes very numerous, occupying the whole of the posterior half of the segment between the two lobes of the ovary. No vitelline gland. Uterus a single transverse tube which becomes undulated and expels its eggs into numerous paruterine organs. Adults in ruminants.

Type-species :—*Thysanosoma actinioides* Diesing, 1835.

Southwell (1913) obtained a worm from *Rhinoceros sondiacus* which he tentatively referred to this genus ; it proved to be a specimen of *Anoplocephala gigantea* (Peters, 1856) Blanchard, 1891.

Genus II. **STILESIA** Railliet, 1893.

Strobila thin and narrow ; outer segmentation apparently always distinct. Longitudinal muscles always in a single layer in the cortex. A single set of genital organs in each segment. Testes in two rows. Cirrus sac ventral, and usually anterior to the vulva on both sides. Genital canals pass between the excretory vessels and dorsally to the nerve. Uterus single, but paruterine organs double in each segment. Parasitic in ruminants.

Type-species :—*Stilesia globipunctata* (Rivolta, 1874).

Key to Species.

Vas deferens closely coiled between cirrus pouch and outer wall of ventral excretory vessel	*S. vittata*, p. 51.
Vas deferens not closely coiled between cirrus pouch and outer wall of ventral excretory vessel	*S. globipunctata*, p. 50.

(1) **Stilesia globipunctata** (Rivolta, 1874) Railliet, 1893.

Synonym : *Tænia globipunctata* Rivolta, 1874.

From (1) Sheep ; Lahore. Gaiger and Southwell. (2) Goats ; Kasauli. Southwell. Camel ; Lahore. Leece.

The worms attain a length of about 60 cm. and a maximum breadth of 2·5 mm.; segmentation is distinct ; all the segments are broader than long, and their posterior lateral corners are produced so as to overhang slightly the anterior lateral margins of the succeeding segment. The genital pores are irregularly alternate and situated near the anterior angles of the proglottides. The head is somewhat square and has a maximum diameter of about 900 μ. The ventral excretory vessel is large and is external to the smaller dorsal vessel.

The longitudinal muscles are well developed and consist of a single layer of small bundles limited internally by a conspicuous band of circular fibres. The testes are in two rows, one row of from 4 to 7 on each side being external to the ventral vessel. The cirrus sac is small and pyriform and is ventral to the vagina; it extends to the nerve. The vas deferens on the pore side, after uniting with the aporal vas deferens, dilates into a conspicuous seminal vesicle situated anteriorly to the testes. The ovary is somewhat globular, and lies immediately median to the ventral vessel. From the pore the vagina pursues a sinuous course to the ventral excretory vessel where it divides into two, one branch, the oviduct, going to the ovary, and the other, the uterine duct, running to the uterus. Eggs pass from the ovary via the oviduct and uterine duct to the uterus. The latter organ develops on the poral side as a globular organ immediately dorsal and close to the ovary; a similar uterine sac (at first solid) develops aporally in the same segment, and these two globular organs become connected by a duct, so that the uterus assumes the form of an elongated dumb-bell. The narrow duct connecting these lateral dilatations of the uterus quickly atrophies, so that the dilated extremity becomes isolated in each segment. From each uterus a paruterine organ develops in the antero-median direction, and into this organ the eggs eventually pass. Vitelline and shell glands are absent; the eggs are few—about 30—and measure about 56 by 27 μ and the embryo 14 μ.

It is open to doubt whether the worms recorded from India under the above name are actually of this species.

(2) **Stilesia vittata** Railliet, 1896. (Fig. 242.)

From sheep; Civil Veterinary Department, Lahore. Southwell.

This species has hitherto not been recorded from sheep or cattle; it occurs, as far as is known, exclusively in the camel and dromedary. It is almost certain that the bottle containing these specimens was wrongly labelled; the worms were probably obtained from a camel. The species attains a length of about 23 cm. and a maximum breadth of about 1·3 mm. Segmentation is not very distinct to the naked eye, but is unmistakable under low magnification. The genital pores are irregularly alternate and are situated in the anterior third of the lateral margin of the segment.

The longitudinal muscles are feebly developed, the bundles being very small and disposed in a single layer. The transverse muscles are also very feebly developed. There are two excretory vessels on each side ; the small dorsal vessel is situated internal to the large ventral one. In each segment there are about 7 testes along each lateral margin, each group of 7 being situated external to the ventral excretory vessel, *i.e.*, in the strobila the testes are in two rows ; they do not atrophy until the paruterine organs are almost fully developed.

The ovary is a small, somewhat globular mass situated on the pore side of each segment between the ventral and the dorsal excretory vessels ; it only occurs in a very few segments, and quickly atrophies. The uterus is single in each segment, consisting of a transverse tube dilated at each lateral extremity, each dilatation being situated between the dorsal and ventral excretory vessels. The tube connecting these dilated extremities atrophies very rapidly, leaving a globular uterine cavity on each side of the segment. Within this uterus a paruterine organ develops, and into it the eggs pass.

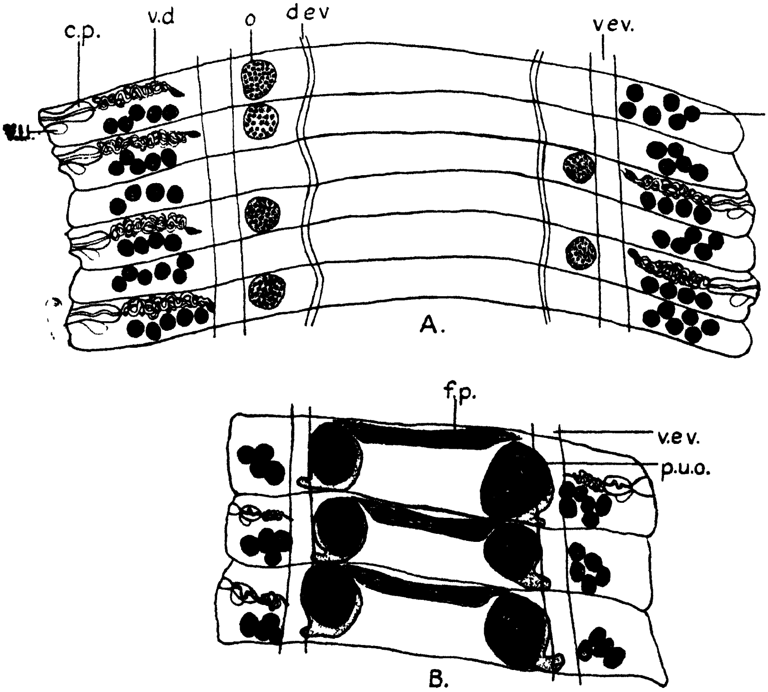


Fig. 242.—*Stilesia vittata*. A, mature segments, × 60 ; B, gravid segments, × 60. (Original.)

This species resembles *S. globipunctata* so very closely that Railliet considered it merely a variety. Apparently the chief point of difference between them is that in *S. vittata* the vas deferens is thrown into a number of close coils between the cirrus sac and the excretory vessels.

Genus III. AVITELLINA Gough, 1911.

Strobila thin and narrow; outer segmentation either distinct or indistinct. Longitudinal muscles in a single layer in the cortex; a second smaller layer of subcuticular fibres may also be present. A single set of genital organs in each segment. Testes in two or four rows. Cirrus sacs dorsal or ventral to the vulvæ, and either anterior or posterior. Genital canals dorsal to both excretory vessels when two are present. Uterus and paruterine organ single in each segment. Parasitic in ruminants.

Type-species :—*Avitellina centripunctata* (Rivolta, 1874).

Key to Species.

1. Outer row of testes only one testis deep..	*A. lahorea*, p. 55.
Outer row of testes more than one testis deep ...	2.
2. Paruterine organ resembles a bunch of bananas in shape....................	*A. goughi*, p. 57.
Paruterine organ pear-shaped	*A. centripunctata*, p. 53.

Rivolta's description of *A. centripunctata* from Italy was very inadequate. Gough (1911) gave a very full account, with figures, of what he believed to be *A. centripunctata* (Rivolta, 1873) from sheep in South Africa. Woodland (1927) has concluded that the species described by Gough is almost certainly not the species originally described by Rivolta, and he has accordingly re-described, from material obtained from Italy, what he believes to be Rivolta's species; and further, he has referred Gough's specimens from South Africa to a species which he has named *A. goughi*.

In view of the fact that Woodland has described a new species of *Avitellina* from sheep in India, viz., *A. lahorea*, it is uncertain whether the records of *A. centripunctata* (Rivolta, 1874) from sheep in India are correct.

(1) Avitellina centripunctata (Rivolta, 1874) (Railliet, 1893). (Fig. 243.)

From a goat; Civil Veterinary Department, Lahore. Camel; Lahore. Southwell. Leece.

The length of the worm is not known, but it probably attains about 250 cm.; the maximum breadth is about 2 mm. The segmentation is quite indistinct to the naked eye, and is not clearly defined even under high magnification. The genital

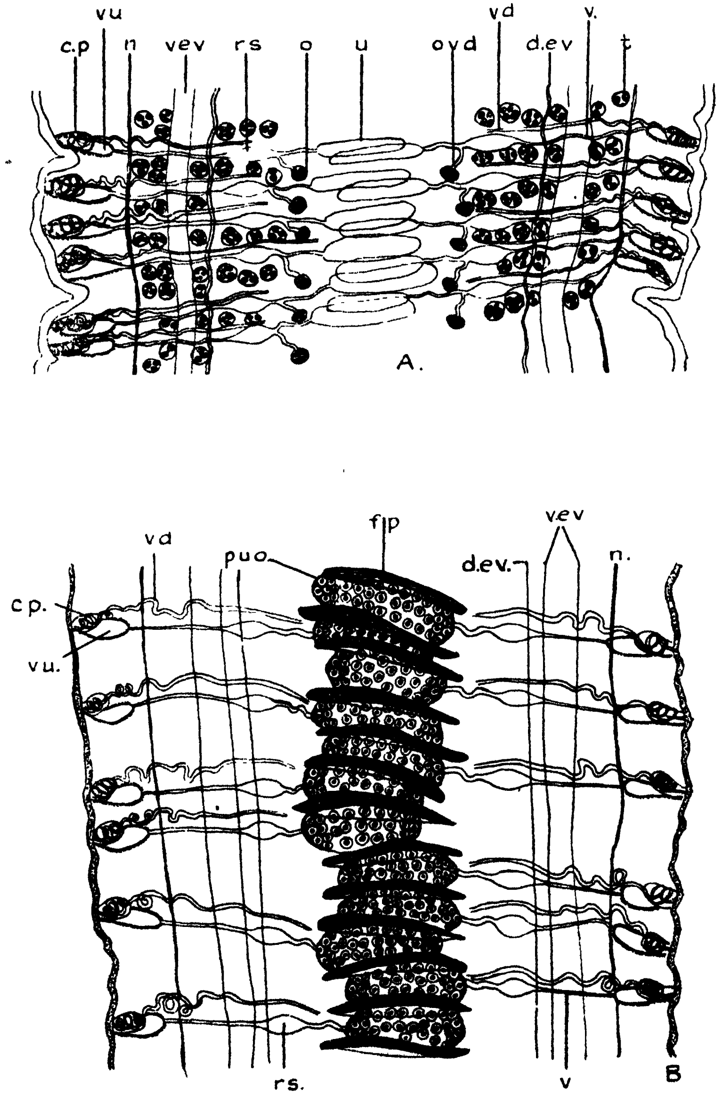


Fig. 243.—*Avitellina centripunctata.* A, mature segments, × 68; B, gravid segments, × 68. (Original.)

pores are irregularly alternate and open near the middle of the lateral margin of the segment.

The longitudinal muscles are definitely in two layers. The ventral excretory vessels on each side are well developed; they are situated externally to the minute dorsal excretory vessels.

The testes are in four rows along the strobila, viz., one row lateral and one row internal to the ventral excretory vessel on each side, the external row consisting of more than one testis. The ovary is single in each segment and is situated internally to both excretory vessels not far from the middle of the segment. The vagina lies posteriorly to the cirrus sac on both sides of the segment; on the left side the vulva is dorsal to the cirrus sac, whilst on the right side it is ventral. The uterus is single in each segment and arises in the mid-longitudinal line; it is quickly replaced by a paruterine organ, which is limited anteriorly by a fibrous cap.

Attention has been called to the fact that Rivolta described this worm originally from sheep in Italy, and that his description was inadequate. Gough in 1911 gave a long and detailed description of *A. centripunctata* from sheep in South Africa. Woodland concluded that the species described by Gough was different from that originally described by Rivolta; he accordingly re-named Gough's species *A. goughi* and gave a full description of the worm, which he believed to be Rivolta's *A. centripunctata*.

(2) **Avitellina lahorea** Woodland, 1927. (Fig. 244.)

From ? sheep or goat; Lahore. Woodland.

This species was described from two fragments of strobila without a head, which together measured 15 cm. in length and had a maximum breadth of 1·94 mm.; one fragment was immature and the other male mature. The gravid segments are not known. The margins of the semi-mature segments are smooth and slightly salient with segmental notches; the genital pores are irregularly alternate and situated near the middle of the lateral margin of each segment.

The longitudinal muscles are disposed in a single layer, the fibres being segregated into ill-defined bundles. A few longitudinal muscles lie scattered beneath the cuticle. Circular and dorso-ventral fibres are scanty. The excretory system consists of the usual two pairs of canals, one pair on each side, the ventral vessels being much larger than the dorsal; the former are situated mid-way between the paruterine organs and the margins, whilst the latter lie on the median side of, and close to, the former. The two lateral nerves lie one on each side just external to the outer row of testes. As in *A. centripunctata*, calcareous corpuscles are almost or entirely absent.

Male Genitalia. The testes are in four rows, one on each side of each of the two ventral excretory vessels. The outer row consists of a single testis on each side of each segment; the number of testes per segment is small, apparently about 6 or 7. The cirrus sac is oval in male mature segments, measuring about

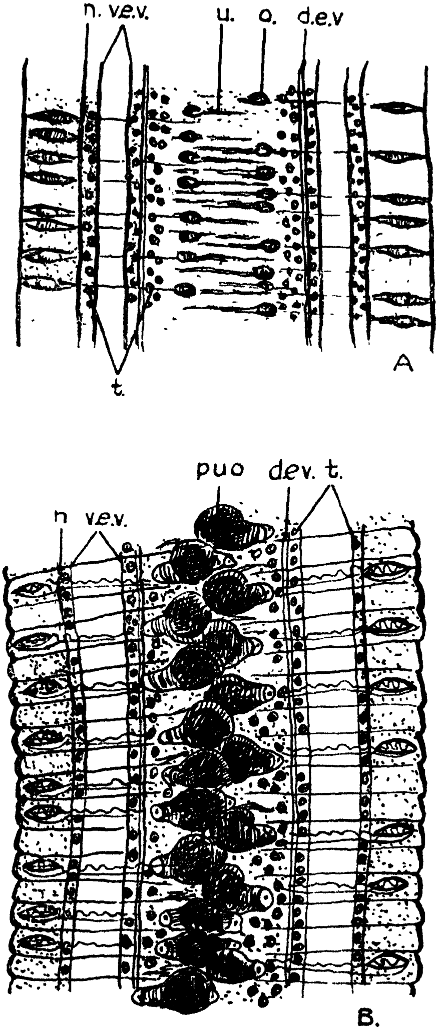


Fig. 244.—*Avitellina lahorea.* A, mature segments, × 33; B, gravid segments, × 33. (After Woodland, in 'Parasitology.')

128 by 55 μ, and extending about halfway between the lateral margin of the segment and the outer wall of the ventral canal; it contains several coils of the vas deferens, and opens, along with the vulva, to a small genital atrium. In surface view the cirrus sacs lie anterior to the vulvæ, and on the right side the sacs are dorsal to the vulvæ, whilst on the left side they are ventral.

Female Genitalia. The ovary is small, spherical, situated on the pore side immediately median to the small dorsal excretory vessel, and measures about 50 μ in diameter. The vagina terminates laterally in a dilatation called the vulva, which opens into the genital sinus. The vulva is more elongate and narrower than the cirrus sac, and is covered with numerous glands. From its internal extremity the vagina continues as a narrow, more or less straight duct, and dilates into a globular receptaculum seminis, immediately internal to the ventral excretory vessel; from the receptaculum seminis the duct bifurcates, one branch running ventrally to the ovary and the other—a dorsal branch—to the paruterine organ. There is a single paruterine organ in each segment, situated in the middle of the longitudinal field of the strobila, the organ in one segment being slightly to the left and the organ in the succeeding segment slightly to the right of the mid-line; this alternation is, however, not strictly regular, there being sometimes two on the left side succeeded by one on the right side, another on the left, two on the right, and so on. The size of the egg is not known.

(3) **Avitellina goughi** Woodland, 1927. (Fig. 245.)

Synonyms:—*Avitellina centripunctata* Gough, 1911.
Stilesia centripunctata Meggitt, 1926.

From (1) Cattle; Lahore. Southwell. (2) Sheep; Punjab. Gaiger. (3) Goat; Rangoon. Meggitt.

The worm measures up to 285 cm. in length, and has a maximum breadth of (often near the head) from 1 to 4 mm. In life it has a gelatinous semi-transparent appearance; when preserved it tends to twist round its long axis. It is very thin dorso-ventrally and easily damaged. About 10 cm. from the head an opaque milky-white mass (paruterine organ) appears in the centre of each segment. The head is unarmed, and the genital pores are irregularly alternate, one to each segment. The segments are all very short, especially in contracted specimens, their posterior lateral margins being salient.

The testes are in four rows, one to the right and one to the left of each of the large ventral longitudinal canals; the dorsal vessel is extremely minute, and lies immediately median to the large ventral vessel.

In the genus *Avitellina* Gough states that the cirrus sac lies ventrally or dorsally, anteriorly or posteriorly to the vagina. He gives figures which "show the sagittal section through about nine sections, passing through four cirri and vaginæ; it will be seen that the utmost possible irregularity has been realised." Woodland attaches no importance to this observation, and states "that in the majority of cases in all *Avitellina* species the cirrus sacs on the left side of the strobila lie ventral to the vulvæ, and on the right side dorsal." Clearly the relation of these genital ducts to each other cannot be considered as definitely determined.

The ovary is situated on the pore side of the segment. The uterus is single, and develops a single large paruterine organ resembling a bunch of bananas which lies in the centre of the segment, giving rise to the milky-white appearance noted above.

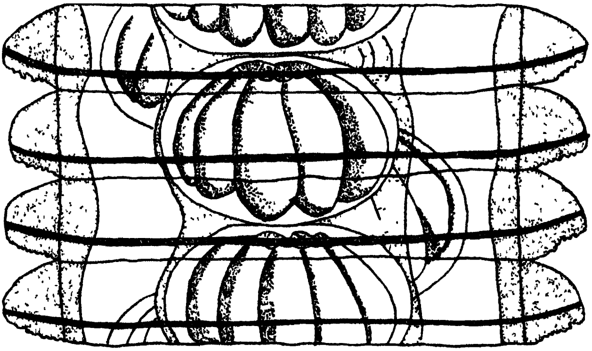


Fig. 245.—*Avitellina goughi.*—Gravid segment, × 99. (After Gough.)

Both vitelline and shell glands are absent. The egg measures about 40 μ in diameter and the oncosphere 20 μ. The embryophore does not bear a pyriform apparatus.

The life-history is entirely unknown.

Subfamily III. LINSTOWINÆ Fuhrmann, 1907.

Worms of variable size; segments often longer than broad. Genital pores double, irregularly alternate or unilateral; genital ducts pass either between, or dorsally or ventrally to the excretory vessels. Testes usually numerous, may be less than ten in number; cirrus sac small or large. Female genital organs median or in poral half of segment; uterus tubular,

resolving into a number of egg-capsules, each of which contains one or several eggs. Adults in mammals, birds, and reptiles.

Type-genus :—*Linstowia* Zschokke, 1899.

Baer includes the following genera in this subfamily :—*Linstowia*, *Oochoristica*, *Thysanotænia*, *Paralinstowia*, *Inermicapsifer*, *Multicapsiferina*, and *Pancerina*, of which only species of the first three genera have as yet been recorded from India.

Key to Genera.

1. Genital pores unilateral	THYSANOTÆNIA, p. 68.
Genital pores irregularly alternate	2.
2. Genital ducts ventral to excretory vessels .	LINSTOWIA, p. 59.
Genital ducts pass between, or dorsal to, excretory vessels	OOCHORISTICA, p. 59.

Genus I. **LINSTOWIA** Zschokke, 1899.

Worms of medium size. Scolex with suckers more or less pedunculated. Genital pores irregularly alternate. Genital ducts pass ventrally to the excretory vessels and nerve. Cirrus sac well developed. Testes numerous, forming a single field dorsal to the female genitalia ; the latter are median. Uterus a transverse tube which becomes transformed into egg-capsules, each containing a single egg ; the latter without pyriform apparatus. Adults in monotremes and marsupials.

Type-species :—*Linstowia echidnæ* (Thompson, 1893).

Linstowia sp. Southwell, 1922.

Two specimens without heads, apparently belonging to this genus, have been recorded from the lizard *Hemidactylus flaviviridis* ; Calcutta. Southwell.

Genus II. **OOCHORISTICA** Lühe, 1898.

Worms of medium size. Adult segments often longer than broad. Genital pores irregularly alternate. Genital ducts pass between, or dorsal to, the excretory vessels. Testes usually numerous, but may be less than ten. Genital organs median. Uterus a transverse tube which may ramify, and which eventually resolves into oviparous capsules, each containing a single egg. Adults in carnivores, insectivores, edentates, marsupials, and reptiles.

Type-species :—*Oochoristica tuberculata* (Rud., 1819).

It is impossible at present to provide a satisfactory key for the identification of the Indian species of this genus.

(1) Oochoristica cryptobothria Linstow, 1906) La Rue, 1911.) (Fig. 246.)

From the tree-snake (*Chrysopelea ornata*); Kurunigala, Ceylon. ? Willey.

The worm attains a length of 13 cm. and a breadth of 2·48 mm. The posterior segments are much longer than broad. The genital pores are irregularly alternate and are situated in the anterior third of the lateral margin of the segment. The cuticle is thick. The head has a diameter of about 600 μ and a terminal organ is absent. The neck measures about 2·3 mm. in length. The longitudinal muscles consist of two layers of bundles, the inner one being very well developed. There are from 80 to 90 testes, situated dorsally in a single field and surrounded by the female glands posteriorly and laterally. The cirrus sac is spindle-shaped, measuring 80 μ in length by 60 μ in breadth. It is furnished with a conspicuous retractor muscle. The vas deferens is thrown into a number of coils which extend to the middle of the segment. The ovary is bilobed and has a breadth of from 360 to 400 μ; it is surrounded posteriorly and laterally by the testes and is slightly asymmetrical. The vitelline gland is situated dorsal to the ovary and has a diameter of 160 μ. The vagina lies posterior to the cirrus sac, and a conspicuous receptaculum seminis is present. The shell gland is large and slightly ventral to the vitelline gland. The formation of the uterus and the disappearance of the ovary takes place very quickly in a few segments. The ventral uterine tubes very quickly lose their walls and the embryos are spread out in the parenchyma, where they lie singly in capsules; the capsules extend laterally beyond the excretory vessels and as far as the longitudinal nerves. The egg measures 52 μ and the oncosphere 20 μ.

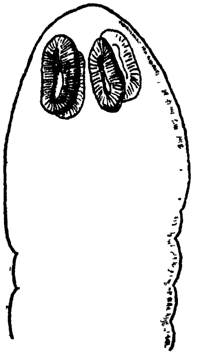


Fig. 246.—*Oochoristica cryptobothrium.* Head, magnification unknown. (After Fuhrmann.)

(2) **Oochoristica agamæ** Baylis, 1919. (Fig. 247.)

From *Hemidactylus gleadovii* ; Rangoon. Meggitt.

The worms measure 8 cm. in length and have a maximum breadth of 1·5 mm. The cuticle is wrinkled ; the posterior margin of one segment does not overlap the succeeding segment. The anterior segments are broader than long ; when the uterus is fully developed the segments are square, and the more posterior ones gradually become much longer than broad. The genital pores are irregularly alternate and are situated a little in front of the middle of the lateral margin of the segment.

The scolex is devoid of a rostellum and has a diameter of about 650 μ. There is a short neck.

Muscular System. The longitudinal muscles are poorly developed, and consist of two layers, an inner of from 25 to 30 dorsal, the same number of ventral bundles, and a much smaller outer layer. Internal to the inner longitudinal layer small dorso-ventral fibres extend across the cortex and medulla.

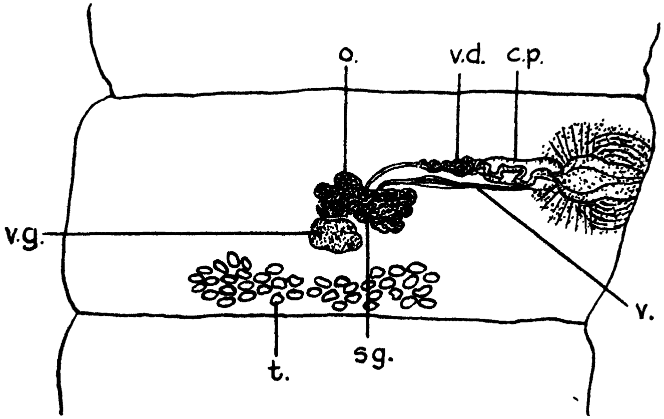


Fig. 247.—*Oochoristica agamæ.* Mature segment, magnification unknown. (After Baylis, in 'Parasitology.')

Excretory System. There are two longitudinal vessels on each side. The dorsal one is small and is usually situated almost directly above the ventral. From the latter numerous small lateral branches are given off which anastomose and form a network in the medullary parenchyma.

Male Genitalia. There are from 39 to 46 testes, usually arranged almost in a straight series of three or four rows across the posterior part of the proglottis ; but in elongated specimens they may assume the form of a horse-shoe, and surround the vitelline gland.

The muscular genital atrium consists of a narrow dorsal portion and a large proximal cavity into which the cirrus opens.

The cirrus sac is pyriform and measures about 150 μ in length and 80 μ in breadth. The vas deferens is much coiled distally. The genital ducts pass between the dorsal and ventral excretory vessels and dorsally to the nerve.

Female Genitalia. The ovary is butterfly-shaped and has a diameter of about 250 μ. Immediately behind it is the vitelline gland. The bilobed ovary and the vitelline gland have the shape of a trefoil-leaf. Between these organs, and situated dorsally, is the shell gland.

The vagina enters the genital atrium posterior and somewhat ventral to the cirrus sac. Between the lobes of the ovary it forms a coil which functions as a receptaculum seminis. Along its course it dilates into a spindle-shaped swelling.

The rudiments of the uterus can be seen in the 7th mature segment as a flattened sac situated ventro-anteriorly to the ovary; it rapidly develops egg-containing processes which eventually extend as far as the limits of the medulla, the ova thus becoming scattered throughout the parenchyma. When fully developed the egg measures 60 μ in diameter and the oncosphere 37 μ.

(3) **Oochoristica crassiceps** Baylis, 1920. (Fig. 248.)

From *Calotes versicolor*; Rangoon. Meggitt.

The worms measure up to 7 cm. in length; they have a maximum breadth of 1·3 mm. and are composed of about 100 segments. The immature ones are much broader than long. Mature and early gravid segments are about twice as broad as long, and the last three or four proglottides are longer than broad. The genital pores are irregularly alternate and are situated in the anterior third of the lateral margin of the segment. The pore leads into a rather large atrium having a length of about 100 μ. The cuticle is wrinkled, and there is very little evidence of external segmentation, the division between the segments being marked only by a slight constriction. A neck is present, and measures 2·5 mm. in length and 900 μ in breadth. The head has a breadth of from 1 to 1·1 mm., the scolex being rudimentary or absent. The suckers are not directed anteriorly but outwardly, and are situated two on the dorsal and two on the ventral surface.

Musculature. The longitudinal muscles are in two layers; the inner layer separates the cortical from the medullary parenchyma and consists of from 20 to 30 bundles dorsally and the same number ventrally. The external longitudinal muscles are situated in the thickness of the cortical parenchyma and consist principally of single fibres vaguely subdivided into two concentric series.

Excretory System. This consists of the usual four tortuous longitudinal vessels, two on each side, situated a little distance from the margin of the segment. One of them is a little larger than the other, but it is difficult to say which is the dorsal and which is the ventral ; anastomoses are scanty or absent.

Male Genitalia. There are from 20 to 30 testes arranged in a single layer behind the ovary in the middle of the field in the posterior part of the segment.

Baylis states that the cirrus sac is pyriform and measures about 150 by 70 μ. According to Meggitt it varies in length from 15 to 19 μ. It is situated in front of the vagina in the same horizontal plane. The vas deferens is much coiled, and there is no specialized seminal vesicle.

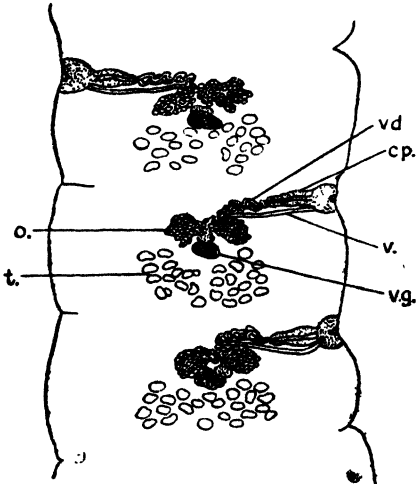


Fig. 248.—*Oochoristica crassiceps.* Mature segments, × about 35. (After Baylis, in 'Ann. & Mag. of Nat. Hist.')

Female Genitalia. The ovary is the most anterior organ, and is situated in the median field slightly on the pore side. It is more or less distinctly bilobed, and has a transverse diameter of about 400 μ. The vitelline gland lies immediately behind it, and attains a diameter of about 100 μ. The shell gland is situated between the ovary and the vitelline gland. The genital ducts pass between the two excretory vessels. Assuming that the larger of these is, as is usual, the ventral vessel, then the ducts pass ventral to the longitudinal nerve; this is, however, contrary to the arrangement obtaining in the other species of the genus. The vagina has a wide lumen for the greater part of its length. The distal portion probably serves as a receptaculum seminis. Just before reaching the female glands it narrows suddenly.

According to Baylis, it is probable that a uterus with a definite wall only exists in two or three segments, if at all; the ova from the first appear to be scattered at random in the parenchyma, without a definite enclosing membrane. Meggitt, however, states that the uterus, which at first is a lobed sac, later on becomes a complex reticulum, and finally breaks down into egg-capsules extending laterally to the excretory vessels.

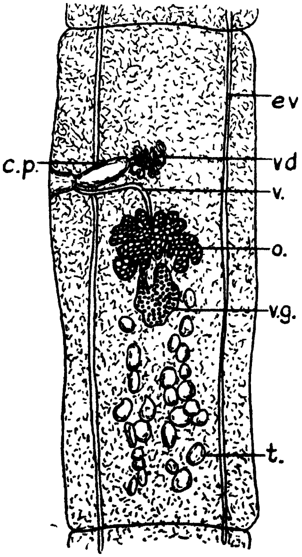


Fig. 249.—*Oochoristica amphisbeteta.* Mature segment, × 78. (After Meggitt, in 'Parasitology.')

(4) **Oochoristica amphisbeteta** Meggitt, 1924. (Fig. 249.)

From the mongoose (*Herpestes albopunctatus*); Rangoon. Meggitt.

The worms have a length of from 1·5 to 4 cm. and a maximum breadth of 450 μ. The mature segments are much longer than broad; external segmentation not well defined, and often invisible posteriorly.

The head has a diameter of 210 μ and bears four suckers, but no rostellum.

The musculature consists of a small inner layer of circular fibres, external to which is a single layer of longitudinal muscle bundles; in addition, a few scattered longitudinal fibres extend to the subcuticula.

In gravid segments the dorsal longitudinal excretory vessel is absent. The rudiments of the genital organs are first visible about 5 mm. behind the head. The genital pores are irregularly alternate and are situated at the junction of the first and second quarters of the margin of the proglottis. They show a tendency to become unilateral. There is a deep genital atrium extending almost to the longitudinal excretory vessel.

There are from 22 to 24 testes situated in the posterior half of the proglottis behind the ovary, the anterior ones being lateral and slightly posterior to the vitelline gland.

The cirrus sac is prominent, extending almost one-third across the proglottis. The cirrus is unarmed; the extensively coiled vas deferens, surrounded by prostate cells, lies immediately median to the cirrus sac.

The ovary is situated near the middle of the segment just posterior to the internal extremity of the cirrus sac; it is bilobed, each half being further subdivided. The vitelline gland is large, reniform, with a deep anterior notch; it is situated directly behind the ovary. There is no receptaculum seminis. The vagina is a simple curved tube devoid of any striking features. The eggs at first lie in groups in the ovary; subsequently they are found in groups in the parenchyma, and finally singly, in capsules, in the parenchyma; a few extend laterally beyond the longitudinal excretory vessels.

(5) **Oochoristica sigmoides** Moghe, 1926. (Fig. 250.)

From *Calotes versicolor*; Nagpur, Central Provinces, India. Moghe.

The worm measures from 2·8 to 8·8 cm. in length and has a maximum breadth of about 1 mm.; the genital pores are irregularly alternate and are situated near the anterior corner of the lateral margin of the segment. A genital atrium, with thick muscular walls, is present. The genital ducts pass between the dorsal and ventral excretory vessels and dorsal to the nerve. The head has a breadth of about 210 μ and is entirely unarmed.

The musculature is weak and consists of an outer layer of scattered longitudinal fibres, an inner layer of longitudinal bundles, and internal to the latter a thin layer of transverse fibres. The dorsal excretory vessels are larger than the ventral; the vessels lie directly dorsal and ventral to each other; they disappear entirely in the posterior gravid segments.

Male Genitalia. There are from 22 to 24 testes in two main groups, one on each side, but posterior to the corresponding lobe of the ovary ; posteriorly they are connected by a row of three or four testes situated behind the vitelline gland. The vas deferens is a narrow straight tube. The cirrus sac measures about 154 to 167 μ by 20 to 25 μ, and extends internal to the excretory vessels ; a portion of the vas deferens lies coiled within it.

Female Genitalia. The ovary is bilobed, and each wing is divided into numerous finger-like lobes ; it is situated in front of the testes, and is a large conspicuous organ. The vitelline gland is lobed and slightly aporal. The shell gland is situated immediately in front of the vitelline gland. The vagina runs parallel and posterior to the cirrus sac and vas deferens, enlarging in the vicinity of the ovary into an S-shaped receptaculum seminis. The uterus breaks up into capsules, each containing a single egg. The latter measures about 27 μ and the oncosphere 15 μ.

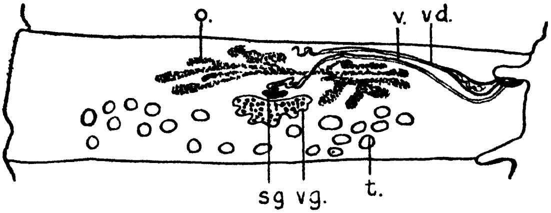


Fig. 250.—*Oochoristica sigmoides.*—Mature segment, × 45. (After Moghe, in 'Rec. Ind. Mus.')

(6) **Oochoristica figurata** Meggitt, 1927. (Fig. 251.)

From *Crocidura murina* ; Rangoon. Meggitt.

The worm attains a length of from 1·1 to 1·6 cm. and a maximum breadth of 1 mm. All the segments are at least twice as broad as long ; the genital pores are irregularly alternate and situated almost at the extreme anterior angle of the margin of the proglottis ; a shallow genital atrium is present.

The scolex has a diameter of 250 μ and resembles the head of species of *Inermicapsifer* ; the suckers are directed anteriorly, and there is a transverse circular constriction separating them from the bluntly conical anterior portion. Immediately behind the head there is a pseudo-segmented portion which terminates with the appearance of the rudiments of the genital organs. The external segmentation of this part of the worm does not correspond to the internal segmentation, as two or three sets of genital rudiments may be present in what appears to be one proglottis.

Male Genitalia. There are from 24 to 33 testes in two distinct equal groups, joined by from 3 to 5 testes all situated behind the female genitalia. The cirrus sac extends to the longitudinal excretory vessels.

Female Genitalia. The ovary is bilobed, the two parts being joined by an extremely fine isthmus. Each half is further divided into a number of digitate processes, and the poral lobe is larger than, and a little anterior to, the aporal one. The vitelline gland is situated slightly on the poral side. A uterus does not appear to develop, because the eggs arise suddenly in capsules even whilst the ovary is functional. The egg capsules are numerous, there being not less than 300; they extend to the cortex, and practically fill the segment.

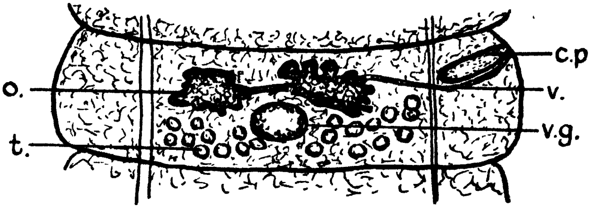


Fig. 251.—*Oochoristica figurata.* Mature segment, × 60. (After Meggitt, in 'Parasitology.')

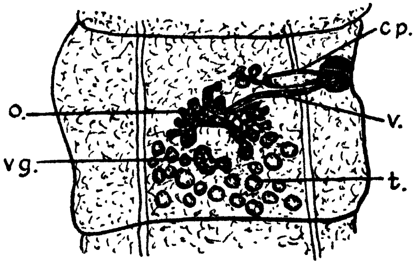


Fig. 252.—*Oochoristica fibrata.* Mature segment, × 80. (After Meggitt, in 'Parasitology.')

(7) **Oochoristica fibrata** Meggitt, 1927. (Fig. 252.)

From *Boiga cyaneus*; Rangoon. Meggitt.

The worm measures from 7 to 9 cm. in length and has a maximum breadth of 1·3 mm. The genital pores are alternating and situated in the anterior fifth or quarter of the margin of the segment. There is a large spherical genital atrium.

Male Genitalia. There are from 35 to 36 testes situated posteriorly to the female glands and extending laterally to the mid-line of the ovary. The cirrus sac measures from 120 to 160 μ by 44 μ; in gravid segments it reaches to the longitudinal excretory vessels, but in mature segments it extends a third the distance across the segment, *i. e.*, median to the excretory vessels.

Female Genitalia. The vagina is situated posteriorly to the cirrus sac; the egg-capsules each contain a single egg; they lie between the longitudinal excretory vessels, occupying the entire proglottis, and penetrating the cortical parenchyma. The species is closely related to *O. agamæ* Baylis, 1919, from which it differs in the arrangement and smaller number of the testes and in the cortical extension of the eggs.

Genus **THYSANOTÆNIA** Beddard, 1911.

Worms of medium size. Genital pores unilateral. Genital ducts pass dorsally to the excretory vessels and nerves. Cirrus sac well developed. Testes numerous, situated on both sides of and behind the female genitalia. Ovary and vitelline gland median. Uterus resolves into parenchymatous capsules, each containing several eggs. Adults in lemurs and marsupials.

Type-species :—*Thysanotænia lemuris* Beddard, 1911.

Thysanotænia incognita Meggitt, 1927. (Fig. 253.)

From *Macropus ruficollis*; Victoria Memorial Park, Rangoon. Meggitt.

The worm attains a length of 5 cm. and a breadth of 900 μ. It is composed of a large number of segments, the posterior ones being longer than broad and resembling those of *Dipylidium caninum*. The genital pores are unilateral and are situated in the centre of the margin of the segment; genital atrium practically absent. The scolex bears neither hooks nor rostellum.

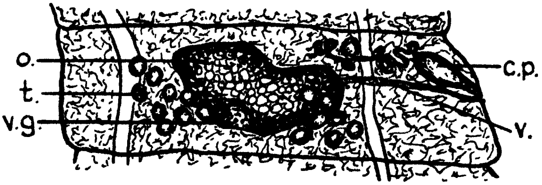


Fig. 253.—*Thysanotænia incognita.* Mature segment, × 80. (After Meggitt, in 'Parasitology.')

Male Genitalia. Testes in groups, 5 or 7 being poral and 11 to 15 aporal; they are not connected, but lie posteriorly to the ovary and internally to the excretory vessels. The cirrus sac measures 180 to 210 μ by 70 to 100 μ, and extends to the longitudinal nerve. Its shape varies according to the degree of contraction, being sometimes cylindrical and sometimes pyriform; it contains a few coils of the vas deferens and apparently a large vesicula seminalis. The vas deferens is much coiled, the coils being situated either externally to or on the excretory vessels.

Female Genitalia. The ovary is an irregular sac situated in front of the testes, and in mature segments occupies most of the proglottis between the excretory vessels. The primary uterus quickly disappears, the eggs passing at once into thin-walled capsules, each containing a single egg, which extend laterally to the excretory vessels.

Family III. DAVAINEIDÆ Fuhrmann, 1907.

Scolex with a simple rostellum armed with one or more rows of very numerous hammer-shaped hooks. Suckers armed or unarmed. A single or double set of genital organs in each segment. Genital pores bilateral, unilateral, or alternating. Uterus persistent or not; in the former case sac-like, in the latter replaced either by numerous egg-capsules or by a single egg-capsule whose formation is preceded by the appearance of a paruterine organ. Eggs with thin transparent envelopes. Adults in mammals and birds.

Type-genus :—*Davainea* Blanchard, 1891.

Key to Subfamilies.

Uterus persistent	**Ophriocotylinæ**, p. 114.
Uterus breaks up into egg-capsules	**Davaineinæ**, p. 69.

Subfamily I. DAVAINEINÆ Braun, 1900.

Rostellum armed with two rows (three in *Porogynia*) of hooks. Suckers armed or unarmed; in the former case with several peripheral rings of stable or unstable hooks. Uterus breaks down into numerous egg-capsules, each containing one or more eggs. Paruterine organ absent. Adults in mammals and birds.

Type-genus :—*Davainea* Blanchard, 1891.

Key to Genera.

1.	Genitalia single	2.
	Genitalia double	COTUGNIA, p. 107.
2.	4 to 15 segments; genital pores regularly alternate	DAVAINEA, p. 72.
	Numerous segments; genital pores unilateral or irregularly alternate	RAILLIETINA, p. 74.

Until recently this subfamily included the genera *Davainea* Blanchard, 1891, *Porogynia* Railliet & Henry, 1909, and *Cotugnia* Diamare, 1893. As the genus *Davainea* contained a very large number of species differing in important points from each other, Fuhrmann (1920) reclassified the species usually placed in the genus, as follows :—

(1) OPHRYOCOTYLOIDES Fuhrmann, 1920. This genus embraces those species in which the uterus is persistent, sac-like, and lobed. Type-species :—*Ophryocotyloides uniuterina* (Fuhrmann, 1909). Meggitt (1924) placed this genus, along with the genus *Ophryocotyle* Friis, 1870, in the subfamily Ophryocotylinæ Fuhrmann, 1907.

(2) DAVAINEA Blanchard, 1891. Fuhrmann limited the characters of this genus so that it contained only species of the *proglottina* type. The characters of the genus are as follows :—Proglottides few, 4 to 15, very small. Suckers very small. Neck absent. Genital pores usually regularly alternate, exceptionally irregularly alternate or unilateral. Cirrus sac large, extending considerably median to the excretory canals. Each uterine capsule with a single egg. Type-species :—*Davainea proglottina* (Davaine, 1860).

(3) DAVAINOIDES Fuhrmann, 1920. Worms with from 6 to 20 longitudinal excretory canals. Strobila broad, nongravid proglottides short. Testes numerous. Genital pores irregularly alternate. Each uterine capsule with a single egg. Type-species :—*Davainoides vigintivasus* (Skrjabin, 1914).

(4) HOUTTUYNIA Fuhrmann, 1920. Strobila large. Rostellum with two rows of hooks and several series of spines. Suckers ? unarmed. Genital pores unilateral. Testes very numerous. Female glands on poral side ; each uterine capsule with several eggs. Type-species :—*Davainea struthionis* (Parona, 1885).

(5) RAILLIETINA Fuhrmann, 1920. Synonym :—*Bothriotænia* Railliet, 1892. Proglottides many, usually considerably more than 15. Suckers of medium size, with several rows of minute, persistent, or deciduous hooks. Genital pores unilateral or irregularly alternate. Scolex rounded, simple. Rostellum with a double (rarely single ?) row of hooks. Each uterine capsule with one or several eggs. Fuhrmann did not

designate a type-species, but Stiles & Orleman (1926) quote *R. tetragona* Molin, 1858 as the type by subsequent designation. Fuhrmann subdivided the genus into the following subgenera :—

(*a*) PARONIELLA Fuhrmann, 1920. With genital pores unilateral ; egg-capsules each contain a single oncosphere. Adults in birds and mammals. Type-species :—*Raillietina* (*Paroniella*) *longispina* (Fuhrmann, 1909).

(*b*) RANSOMIA Fuhrmann, 1920. With genital pores unilateral ; egg-capsules each contain several oncospheres. Adults in birds and mammals Type-species :—*Raillietina* (*Ransomia*) *tetragona* (Molin, 1858)

(*c*) SKRJABINIA Fuhrmann, 1920. With genital pores irregularly alternate. Egg-capsules each contain a single oncosphere. Adults in birds and mammals. Type-species :—*Raillietina* (*Skrjabinia*) *cesticillus* (Molin, 1858).

(*d*) JOHNSTONIA Fuhrmann, 1920. With genital pores irregularly alternate. Egg-capsules each contain several oncospheres. Adults in birds and mammals. Type-species :—*Raillietina* (*Johnstonia*) *echinobothrida* (Mégnin, 1880).

Later (1924), in order to conform to the rules of zoological nomenclature, Fuhrmann altered the name of his subgenus *Johnstonia* to *Raillietina*, and gave as the type-species *R. crassula* (Rudolphi, 1819). Stiles & Orleman (1926) substituted the name *Fuhrmannetta* for the subgenus *Johnstonia* Fuhrmann, 1920, and *Raillietina* for *Ransomia* Fuhrmann, 1920.

The genus *Houttuynia* Fuhrmann, 1920, was established to accommodate those species of Davaineidæ in which the rostellum, in addition to being armed with the usual T-shaped hooks, bears a spiny collar, and in which the genital pores are unilateral and each egg-capsule contains several eggs. In the table given below it will be obvious that the genus as at present defined cannot stand, because in at least two species in which the rostellum bears a spiny collar the egg-capsules each contain a single egg, the arrangement of the genital pores in these species being unknown. In four other species the genital pores are irregularly alternate, but in two of these it is not known whether the egg-capsules contain one or several eggs. It is therefore necessary either to emend the characters of the genus or subdivide it, as has been done in the genus *Raillietina*, or consider it invalid and merge the species in the genus *Raillietina*. In this connection it is important to note that Meggitt states that in his species *R. birmanica* the spiny collar can only be seen when the parasite is alive, and this probably applies to other species as well.

For the reasons given above the writer is unable to accept the genus *Houttuynia*.

Table showing Species of Indian Davaineidæ in which the Rostellum bears a Spiny Collar.

Species.	Genital pores.	No. of eggs in capsules.
Raillietina (*R.*) *celebensis*..............	Unilateral.	Several.
Raillietina (*R.*) *flabralis*	Unilateral.	Several.
Raillietina (*R.*) *celebensis* var. *paucicapsulata.*	Unilateral.	Several.
Houttuynia torquata....................	Unilateral.	Several.
Raillietina (*R.*) *birmanica*	Irregularly alternate.	Several.
Raillietina (*F.*) *pseudoechinobothrida*	Irregularly alternate.	Several.
Raillietina (?) *reynoldsæ*	Not known.	One.
Raillietina (?) *fatalis*	Not known.	One.
Raillietina (?) *fluxa*	Irregularly alternate.	Unknown.
Raillietina (?) *indica*	Irregularly alternate.	Unknown.

Genus I. **DAVAINEA** Blanchard, 1891.

Strobila very small, consisting of from 4 to 15 proglottides. Suckers small. Musculature feebly developed. Genital pores irregularly alternate. Cirrus sac large, extending well beyond the longitudinal excretory vessels. Testes relatively few. Egg-capsules each contain a single egg. Adults in birds, larval stages in molluscs.

Type-species :—*Davainea proglottina* (Davaine, 1860).

(1) **Davainea proglottina** (Davaine, 1860) R. Blanchard, 1891. (Fig. 254.)

Synonyms :—*Davainea proglottina* var. *dublanensis* (Kowal., 1894) Fuhrmann, 1905.
Davainea varians Sweet, 1910 (=*dubius* Meggitt, 1916).

From the domestic fowl ; Rangoon. Meggitt.

The species appears to be very variable both in size and structure. Possibly these variations are due to age, state of preservation, or to errors of observation.

The worm measures about 4 mm. in length and has a maximum breadth of 600 μ. They usually consist of from 4 to 6 segments (? 9 occasionally) ; the posterior ones grow considerably in length even whilst attached to the strobila, and also subsequently. This fact possibly explains the variations noticed in the length of the worm. The genital pores are regularly alternate and situated near the anterior extremity of the segment. The scolex is very small and armed with from 80 to 95 hooks, each measuring from 5 to 8 μ; in *D. varians*, however, there are said to be from 44 to 50. The suckers are armed with a few rows of minute rose-thorn-shaped hooks. The male genital organs are usually fully developed in the second segment and the ovary in the third segment; they both disappear quickly.

Male Genitalia. The testes vary a little in number, there being usually 19 (Blanchard gives 22, Marotel 12 or 13); they are situated behind the female organs in the posterior half of the segment. The cirrus sac is rather large, extending almost to the middle of the segment. The cirrus is armed with long silky hairs.

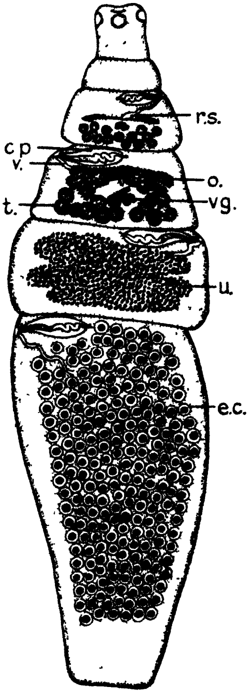


Fig. 254.—*Davainea proglottina.* Entire worm, × 53. (Original.)

Female Genitalia. The ovary is a bilobed organ situated near the middle of the segment, anteriorly to the testes. The vagina lies posteriorly to the cirrus sac; its lumen is covered with fine hairs; about the middle of the segment it dilates into a receptaculum seminis. The uterus at first consists of a central cavity with lobes extending into the parenchyma; the walls eventually disappear, and the eggs thus come to lie free in capsules each containing a single egg. Sweet states that she has occasionally found from 2 to 13 eggs in each capsule. Fuhrmann considers that this condition merely indicates that the segment was not fully developed.

The larval stages occur in slugs such as *Agriolimax agrestis*, *L. cinereus*, and *L. variegatus*. Distribution cosmopolitan.

Jones (1929) reports obtaining larvæ of *D. proglottina* in the following snails :—*Zonitoides arborea*, *Vallonia indentata*, *Gasterodonta ligera*, and *Polgyra thyroides*.

Genus II. **RAILLIETINA** Fuhrmann, 1920.

Synonym :—*Bothriotænia* Railliet, 1892.

Proglottides many, usually considerably more than 15. Suckers of medium size, armed or unarmed. Genital pores unilateral or irregularly alternate. Scolex rounded, simple. Rostellum with a double (rarely single ?) row of hooks. Each uterine capsule with one or several eggs. Adults in mammals and birds. Larval stages in insects and reptiles.

Type-species :—*Raillietina tetragona* (Molin, 1858).

Key to Subgenera.

1.	Genital pore unilateral	2.
	Genital pores irregularly alternate	3.
2.	Egg-capsules each containing several eggs.	RAILLIETINA, p. 74.
	Egg-capsules each containing one egg	PARONIELLA, p. 90.
3.	Egg-capsules each containing several eggs.	FUHRMANNETTA, p. 99.
	Egg-capsules each containing one egg	SKRJABINIA, p. 97.

Subgenus (*a*) *RAILLIETINA* Stiles & Orleman, 1926 (=*Ransomia* Fuhrmann, 1920).

The genital pores are unilateral and the egg-capsules each contain several oncospheres. Type-species :—*Raillietina* (*Raillietina*) *tetragona* (Molin, 1858).

It is not possible to give a satisfactory key to the Indian species of this subgenus.

(1) **Raillietina (Raillietina) tetragona** (Molin, 1858). (Fig. 255.)

Synonyms :—*Tænia tetragona* Molin, 1858.
Davainea tetragona (Molin, 1858) R. Blanchard, 1891.
Tænia botrioplites Filippi, 1892.
Monocercus davaineæ-tetragonæ Railliet, 1898.

From (1) Domestic fowl ; Berhampur, Bengal. Southwell. Burma. Meggitt. (2) *Pavo muticus*, *P. cristatus*. (3) *Francolinus vulgaris* ; Zoological Gardens, Calcutta. Southwell.

The worm attains a maximum length of 25 cm. and a breadth of from 1 to 4 mm. The genital pores are unilateral and are situated near the centre of the lateral margin of the segment. The scolex is large ; the rostellum is armed with about 100 hooks really arranged in a double row, but appearing to lie in a single row; each has a length of from 6 to 9 μ. The suckers are armed with from 8 to 10 rows of hooks.

There are from 20 to 30 testes; the cirrus sac does not reach the ventral excretory vessels. Each segment contains from 50 to 100 egg-capsules which extend externally to the excretory vessels. There are from 6 to 12 eggs in each capsule, each egg having a diameter of from 25 to 50 μ. The larval form occurs in *Musca domestica*.

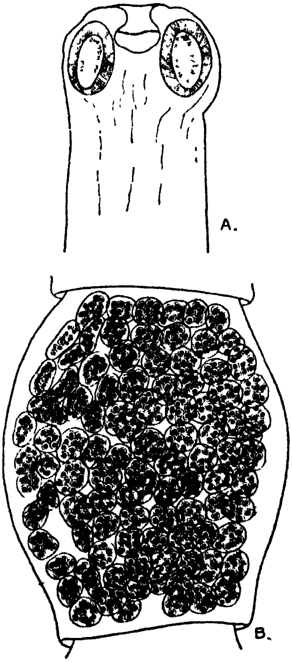


Fig. 255.—*Raillietina (R.) tetragona.* A, head, × 56; B, gravi segment, × 26. (Original.)

(2) Raillietina (Raillietina) leptosoma (Diesing, 1850).

Synynym :—*Tænia leptosoma* Diesing, 1850.

From *Platycercus eximius*; Burma. Meggitt.

The worm attains a length of 16 mm. and a breadth of 2 mm. The genital pores are unilateral. The head is armed with a double row of about 70 hooks. Accessory hooks absent. The suckers are armed.

Mature segments contain 60 testes which do not extend outwards beyond the nerve. The cirrus sac extends a little internally to the excretory vessels. Each egg-capsule contains about 20 eggs.

(3) Raillietina (Raillietina) friedbergeri (Linstow, 1878) Fuhrmann, 1920. (Fig. 256.)

Synonyms:—*Tænia friedbergeri* Linstow, 1878.
Tænia agama Megnin, 1878.
Tænia infundibuliformis var. *phasianorum* Neumann, 1878.

From the black-shouldered peacock (*Pavo nigripennis*); Berhampur, Bengal. Southwell.

The worm measures up to 20 cm. in length and has a maximum breadth of about 3 mm. All the segments are broader than long. The genital pores are unilateral and are situated a little posteriorly to the middle of the lateral margin of the segments. The head is somewhat pyriform and measures about 300 μ in length by 400 μ in breadth. The rostellum is armed with about 150 hooks arranged in a double crown, each hook having a length of about 12 μ. The suckers are armed with 4 or 5 rows of small hooks which decrease in size towards the middle of the suckers.

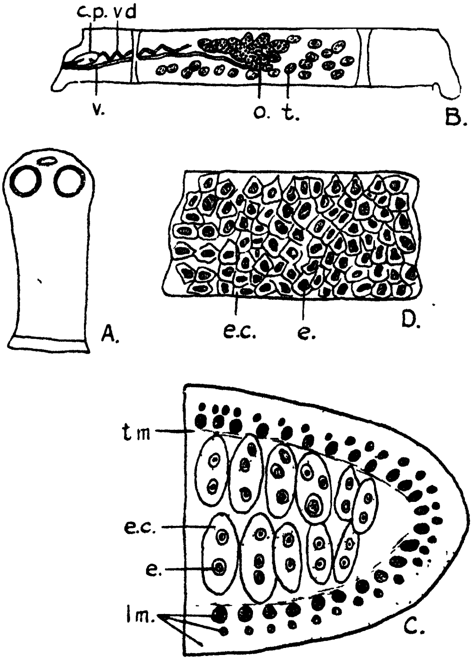


Fig. 256.—*Raillietina* (*R.*) *friedbergeri*. A, head; B, mature segment; C, transverse section of gravid segment; D, gravid segment. Magnification unknown. (After Baczyńska.)

The longitudinal muscles are arranged in a double layer of bundles. There are from 25 to 32 testes ; on the pore side all the testes, about 7 or 8 in number, lie posteriorly to the ovary and vagina, the remaining testes being situated posteriorly and laterally to the ovary. The cirrus sac is very small, extending less than half the distance to the excretory canal. The cirrus is armed.

The ovary is a conspicuous lobed organ situated in front of the testes. The vagina lies posteriorly to the cirrus sac and dilates into a small receptaculum seminis mear the middle of the segment. Each segment contains about 100 egg-capsules which have a diameter of about 156 μ and extend laterally to the excretory vessels ; each contains 2 or 3 eggs.

(4) **Raillietina (Raillietina) celebensis** (Janicki, 1902).

Synonym :—*Davainea celebensis* Janicki, 1902.

From *Nesocia bengalensis* ; Rangoon, Burma. Meggitt.

The worm attains a length of 30 cm. and a breadth of 1·1 mm. The genital pores are unilateral and are situated near the anterior extremity of the lateral margin of the segment. The rostellum has a diameter of from 130 to 180 μ and is armed with from 100 to 130 hooks, each of which measures from 20 to 26 μ in length, arranged in a double row. Immediately behind the rostellum there is a collar armed with spines; the suckers are unarmed. There are from 26 to 38 testes, of which 9 to 15 are poral and 17 to 23 aporal. The cirrus sac measures from 113 to 146 μ by 54 to 65 μ in mature segments, and extends to the nerve. There are from 180 to 200 egg-capsules in each segment, a few extending laterally to the excretory vessels ; each capsule contains from 3 to 4 eggs.

(5) **Raillietina (Raillietina) microscolecina** (Fuhrmann, 1909).

Synonym ;—*Davainea microscolecina* Fuhrmann, 1909.

From (1) A parrot (*Eclectus rosatus*=*Lorius roratus*) ; Zoological Gardens, Calcutta. Southwell. (2) *Cacatua moluccensis* ; Victoria Memorial Park, Rangoon. Meggitt.

The worm attains a length of from 7 to 10 cm., a maximum breadth of 1 mm., and is composed of very numerous segments. The genital pores are unilateral and are situated slightly in front of the middle of the lateral margin of the segment.

The scolex has a diameter of about 180 μ ; the rostellum has a length of 600 μ and is armed with from 160 to 200 hooks which according to Fuhrmann measure 9 or 10 μ in length, according to Meggitt 13 or 14 μ. The suckers are armed anteriorly with 7 rows of hooks which may be entirely absent from the posterior margin. In the parenchyma there are numerous calcareous corpuscles measuring 10 μ.

Male Genitalia. There are from 16 to 20 testes. The cirrus sac, according to Fuhrmann, has a length of 48 μ, whilst according to Meggitt it attains a maximum length of 150 μ. Each gravid segment contains about 45 egg-capsules, each of which at first contains a single egg, but which, later on, may contain from 1 to 7.

Meggitt writes that the "appearance suggests that the eggs are at first shed from the uterus into the parenchyma, become enclosed separately by modified parenchyma, and that the final capsules are formed by the coalescence of the primary capsules."

(6) **Raillietina (Raillietina) aruensis** (Fuhrmann, 1911).

Synonym:—*Davainea aruensis* Fuhrmann, 1911.

From *Lorius lory*; Victoria Memorial Park, Rangoon. Meggitt.

The worm attains a length of 26 cm. and a maximum breadth of 2 mm. It is composed of numerous segments, and the genital pores are unilateral. The scolex measures 300 μ in length and the suckers are unarmed. The rostellum measures 100 μ in length and is armed with 180 to 230 hooks, each measuring 17 or 18 μ in length and arranged in a double row.

Male Genitalia. Fuhrmann states that there are 20 testes, 14 being aporal and 6 poral; Meggitt, however, says that there are from 10 to 17 testes. The cirrus sac is oval and measures 130 μ in length; it contains a vesicula seminalis and extends almost to the excretory vessels; the cirrus is armed. The vas deferens lies coiled near the middle of the segment and is surrounded with prostatic cells.

Female Genitalia. The ovary is fan-shaped and has a breadth of about 400 μ. The mouth of the vagina is surrounded with a sphincter muscle. The vitelline gland is compact and median, behind the ovary, and has a breadth of 100 μ. The eggs are in capsules, the latter not extending laterally to the excretory vessels. Each contains numerous eggs. Meggitt states that his specimens, obtained from an unusual host, were abnormal in all respects; many of the segments were wholly or partly sterile, male organs were present without female, or *vice versa*, and, in fact, various types of abnormalities were present.

(7) **Raillietina (Raillietina) cohni** Baczyńska, 1914. (Fig. 257.)

Synonym:—*Davainea cohni* Baczyńska, 1914.

From *Pterocles exustus* and *P. arenarius*; Zoological Gardens, Calcutta. Southwell.

The worm attains a length of from 2 to 3 cm. and a breadth of 1·7 mm. All the segments are broader than long; the genital pores are unilateral and are situated a little in front of the middle of the lateral margin of the segment. The scolex has a length of 192 μ and a breadth of 240 μ. The rostellum has a length of 33 μ and bears about 160 hooks arranged in a double row, each having a length of 8 μ. Each sucker is armed with 14 rows of hooks. The neck has a length of 1·62 mm. and a breadth of 160 μ. There are from 10 to 15 testes, disposed for the most part aporally. A single row of testes lies posteriorly to the female genital organs, as in *D. penetrans* Baczynska, 1914. The vas deferens forms a few loops within the cirrus sac; outside the sac it follows an undulating course to the middle of the segment. The cirrus sac is very small and pyriform, measuring about 78 μ in length and 28 μ in breadth.

The ovary is much lobed and ramified and has a breadth of 640 μ; it is situated in the anterior part of the segment; immediately behind it is the vitelline gland; this is also lobed, and has a breadth of 104 μ. The vagina opens posteriorly to the cirrus sac, and its terminal part is muscular; near the middle of the segment it dilates into a receptaculum seminis. The vagina measures about 100 μ in length and 18 μ in breadth. The eggs are grouped in capsules; each of the latter has a diameter of 130 μ, and apparently contains 2 or 3 eggs; they extend laterally to the excretory vessels.

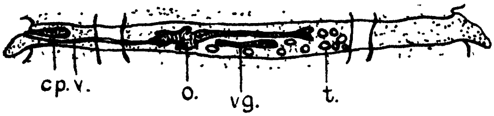


Fig. 257.—*Raillietina* (*R.*) *cohni*. Mature segment, magnification unknown. (From Meggitt, after Baczyńska.)

(8) **Raillietina (Raillietina) spiralis** (Baczyńska, 1914). (Fig. 258.)

From (1) Pigeons (*Columba* sp.); Zoological Gardens, Calcutta. Southwell. (2) *Crocopus phœnicopterus*; Zoological Gardens, Calcutta. Southwell.

The worm measures 3 to 4 cm. in length and has a breadth of about 1·28 mm. All the segments are much broader than long. The genital pores are unilateral and are situated at the extreme anterior corner of the lateral margin of the segment. The genital ducts pass between the excretory vessels. The head is relatively large and has a diameter of about 224 μ. The four suckers are very small and are armed anteriorly with

7 rows of very fine hooks. The rostellum is large and has a diameter of 150 μ; it is armed with about 300 hooks, each having a length of about 16 μ. The longitudinal muscles are disposed in 3 rows of bundles, the most internal layer being the largest. In addition, there are isolated longitudinal muscles in the cortical parenchyma.

As in *Davianea paucitesticulata* Fuhrmann, 1909, the testes are few in number. The vas deferens has an undulating course and is surrounded laterally by numerous prostatic cells. The cirrus sac is muscular and has a length of about 100 μ; the cirrus is also very muscular and is armed with long silky hairs. Where the vas deferens enters the cirrus sac there is a strong sphincter muscle. The ovary is flat and has a breadth of 352 μ. The vitelline gland is relatively large, situated behind the ovary, and measures about 83 μ. The vagina opens posteriorly and ventrally to the cirrus sac. Near the pore it is very muscular and is furnished with a strong sphincter muscle, as is the cirrus sac. The vagina runs in the median direction, almost in a straight line, and dilates into a small fusiform receptaculum seminis which has a length of about 52 μ. The eggs are in capsules which are not numerous; each has a diameter of about 104 μ and contains from 4 to 6 eggs; they do not extend laterally to the excretory vessel.

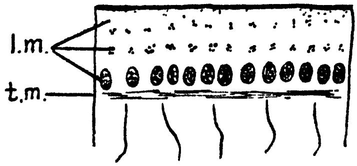


Fig. 258.—*Raillietina (R.) spiralis.* Transverse section, showing musculature, magnification unknown. (After Baczyńska.)

(9) **Raillietina (Raillietina) polychalix,** Kotlán, 1920–21. (Fig. 259.)

Synonym:—*Davainea polychalix* Kotlán, 1920–21.

From *Lorius garrulus*; Zoological Gardens, Calcutta. Southwell.

The worm attains a length of 5·5 cm. and a maximum breadth of 1·7 mm. The segments are all broader than long and very shallow. The genital pores are unilateral and are situated at the extreme anterior corner of the lateral margin of the segment. The scolex has a breadth of 320 μ; the rostellum is armed with from 240 to 250 hooks, each having a length of about 13 μ and arranged in a double row. The suckers are armed with 4 or 5 rows of minute hooks.

The longitudinal muscles are arranged in a double layer of bundles. There are about 10 testes, 4 being poral and lateral to the ovary and 6 being aporal and also lateral to the ovary. The cirrus sac is small, extending only half the distance from the margin to the nerve ; within the sac there is a conspicuous seminal vesicle. The vas deferens follows a sinuous course, but is not coiled. The ovary is situated in the middle of the segment and is not bilobed ; immediately posterior to it is a small vitelline gland. Each segment contains from 24 to 26 egg-capsules, which extend laterally to the excretory vessels and contain each from 2 to 5 eggs.

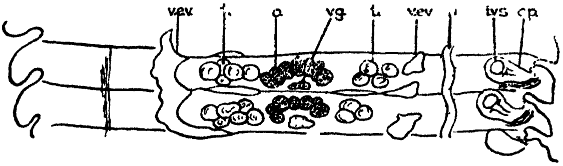


Fig. 259. –*Raillietina* (*R.*) *polychalix*. Mature segment, × 113. (After Kotlán.)

(10) **Raillietina (Raillietina) fuhrmanni** (Southwell, 1922). (Figs. 260, 261, & 262.)

Synonym :—*Davainea fuhrmanni* Southwell, 1922.

From (1) *Crocopus phœnicopterus* ; Calcutta. Southwell. Victoria Memorial Park, Rangoon ; Meggitt. (2) *Crocopus phayrei* ; Calcutta. Southwell.

The worm attains a maximum length of about 8 cm. and a breadth of 700 μ ; it exhibits very considerable variations ; in young segments the genital pores, which are unilateral, are situated at the extreme anterior margin, whilst in mature and gravid ones each is slightly in front of the middle. The segments vary in shape ; in some worms they are all broader than long except the last few, which are square ; in other specimens they are somewhat bell-shaped ; whilst in still others the terminal proglottides are twice as long as broad. The longest posterior segment measures 1·2 mm. in length and 700 μ in breadth. The head has a length of 330 μ and a breadth of 250 μ. The large rostellum, which is about 100 μ in length and 150 μ in breadth, is armed with a double row of about 110 hammer-shaped hooks, each measuring from 25 to 30 μ, the hooks in the anterior row being slightly larger than those in the posterior row. There is no rostellar collar. The suckers have a diameter of about 70 μ and are armed with several rows of minute hooks ; according to Meggitt, however, they bear only 2 to 3 rows. The neck varies in length from 300 μ to 1·4 mm. There is a single nerve situated laterally to the ventral water-vessel and ventrally to the cirrus sac. A single (ventral) excretory vessel runs along each lateral margin; that on the pore side lies ventrally to the cirrus sac, and is situated further from the lateral margin than is the aporal vessel. This asymmetry is not, however, always pronounced.

Muscular System. The longitudinal muscles are well developed; the bundles are arranged in a single layer, the external being smaller in every way than the internal bundles; the arrangement is best seen in young adults. The circular fibres consist of a very narrow layer lying immediately internally to the longitudinal fibres. Oblique fibres are very scanty.

Fig. 260.

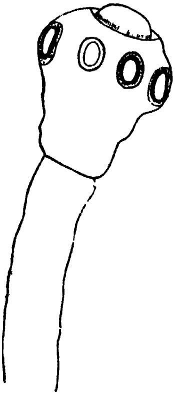
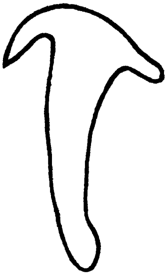


Fig. 261.



Raillietina (*R.*) *fuhrmanni.*

Fig. 260.—Head and neck, × 170. (After Southwell.)
Fig. 261.—Rostellar hook, × 1125. (After Southwell.)

Male Genitalia. The testes lie dorsally, and are about twelve in number; seven or eight on the aporal side of the ovary, one or two posteriorly and laterally to the yolk gland, and the rest—usually three—on the poral side of the ovary; they do not extend beyond the water-vessels. The vas deferens is a long, loosely-coiled, slightly dilated tube, extending quite halfway across the segment, and surrounded throughout its length by a dense mass of glandular tissue—the prostate gland; it reaches its full development somewhat late; seminal vesicle apparently absent, probably the elongated vas deferens functions as such. The cirrus sac is large and measures, in mature segments, about 170 μ in length and 80 μ in breadth.

According to Meggitt, it has a length of 87 to 98 μ only. It lies across the antero-lateral angle of the segment and extends just median to the lateral excretory vessel. The cirrus is armed with large spines measuring about 17 μ ; these, however, cannot always be seen.

Female Genitalia. The ovary is sometimes bilobed, each lobe having a rounded appearance. According to Meggitt, it consists when young of three or four large, entire, spherical lobes, but when it is mature it becomes sac-like. It is placed slightly behind the centre of the segment. The vagina is a long, muscular, sinuous tube ; the terminal portion which lies posteriorly to the whole length of the cirrus sac is often, but not always, dilated. Its extreme lateral extremity opens at the base of a well pronounced sinus, situated immediately behind the cirrus sac ; a well developed sphincter muscle surrounds the opening of the vaginal sinus. Slightly in front of the ovary the vagina dilates into a small but somewhat elongated receptaculum seminis. The vitelline gland lies posteriorly to the ovary, and is easily seen ; in size it is almost equal to one wing of the ovary. The uterus is first visible as a small irregular cavity, situated immediately anterior to the vitelline gland ; it enlarges rapidly, eventually filling the entire segment between the water-vessels. The eggs when first seen appear as a dense granular mass filling the uterus. A few segments further back 40 capsules are differentiated, each containing six or seven, and rarely nine to eleven, oncospheres. At first the mature uterus lies strictly within the excretory vessels, but in the last five or six segments these have disappeared, and the entire segment is occupied by the capsules. Black pigment occurs abundantly in the posterior two-thirds of the worm. The egg measures about 36 μ.

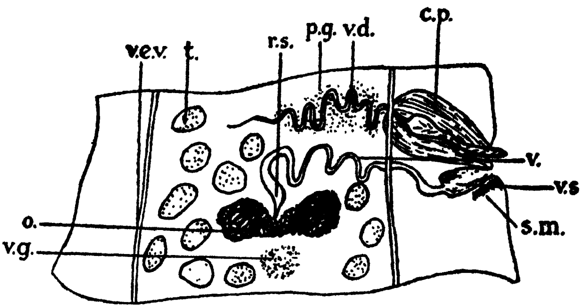


Fig. 262.—*Raillietina (R.) fuhrmanni.* Mature segment, × 140. (After Southwell.)

(11) **Raillietina (Raillietina) parviuncinata** Meggitt, 1924.

From ducks; Rangoon. Meggitt.

The worm attains a length of from 11 to 12 cm. and a breadth of 200 μ. All the proglottides are broader than long except a few of the posterior ones, which are longer than broad. The genital pores are unilateral and are situated slightly anterior to the centre of the lateral margin of the segment. The scolex measures from 260 to 370 μ in diameter. The rostellum has a diameter of from "0·026 to 0·3 mm." (*sic*), and extends posteriorly past the anterior margin of the suckers; it is armed with about 150 T-shaped hooks arranged in two rows, each having a length of from 7 to 9 μ. The suckers are armed with 9 rows of hooks which decrease in size towards the centre of the suckers.

Muscular System. The muscles are weakly developed and consist of an inner transverse and an outer longitudinal layer; the latter comprises a number of widely scattered small bundles extending to the subcuticula.

Male Genitalia. The testes vary in number from 24 to 39, the average number being about 27; of these, 9 to 12 are poral and 18 to 20 aporal. A few testes may extend laterally to the excretory vessel. The vas deferens is only slightly coiled. The genital ducts pass between the longitudinal excretory vessels. The cirrus sac varies in length from 580 to 840 μ, extending median to the nerve.

Female Genitalia. The ovary, which is slightly poral, consists of a small central mass from which radiate numerous tubular outgrowths. The vitelline gland is compact and is situated behind and slightly lateral to the middle of the ovary. Between the excretory vessel and the ovary the vagina dilates into a long conspicuous receptaculum seminis. Each segment contains up to 50 egg-capsules, which extend laterally to the excretory vessels. The mature capsule contains from 11 to 13 eggs.

(12) **Raillietina (Raillietina) torquata** (Meggitt, 1924). (Fig. 263.)

Synonym:—*Houttuynia torquata* Meggitt, 1924.

From pigeons (*Columba* sp.); Rangoon. Meggitt.

The worm attains a length of 23 cm. and a maximum breadth of 2·5 mm. The scolex has a diameter of about 90 μ. The rostellum is armed with about 150 hooks measuring 7 and 7·5 μ, the two sizes alternating. Surrounding the posterior part of the rostellum is a barrel-shaped collar thickly studded with deciduous hooks each 8 μ in length. The posterior segments are slightly longer than broad. The genital pores are unilateral and are situated near the centre of the margin of the proglottis; the genital atrium is small.

Muscular System. This is weak, and consists of a double layer of transverse fibres, external to which there are, both dorsally and ventrally, from 13 to 18 longitudinal muscle bundles. Externally to the latter a second layer of scattered longitudinal fibres extends to the subcuticula. A few dorso-ventral muscles are also present.

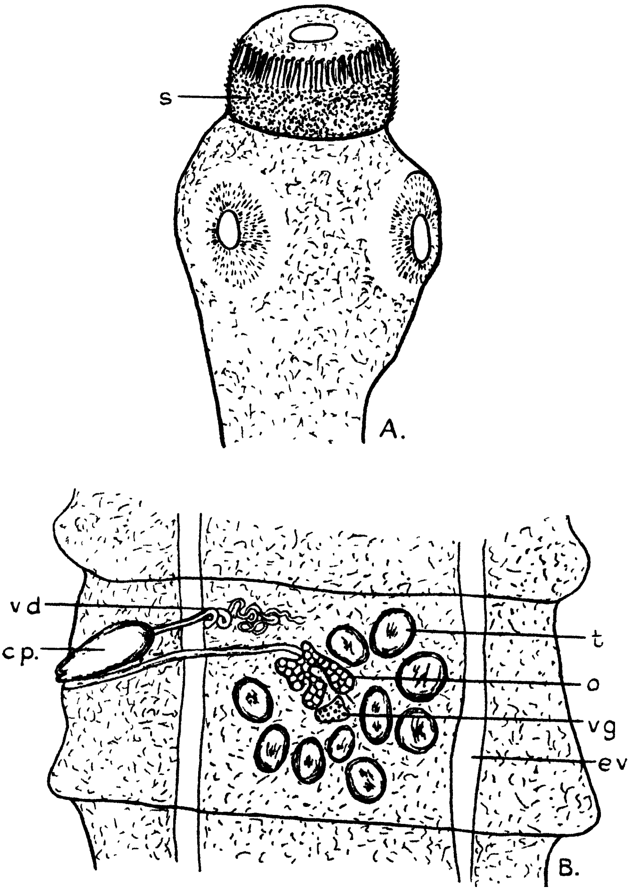


Fig. 263.—*Raillietina (R.) torquata.* A, head, × 427; B, mature segment, × 133. (After Meggitt.)

Excretory System. This consists of four longitudinal vessels. In immature segments a fifth vessel may be present.

Male Genitalia. There are from 8 to 10 testes, two poral, one or two posteriorly to the ovary, and the remainder aporal.

The cirrus sac is small, extending only to the nerve ; it contains a small vesicula seminalis. The cirrus is armed ; internally to the longitudinal excretory vessel the vas deferens is thrown into a number of coils.

Female Genitalia. The ovary consists of two subdivided lobes, and is situated near the centre of the segment. The vagina is a simple tube, and a receptaculum seminis is absent. The vitelline gland lies immediately behind the ovary. The primary uterus disintegrates, and the eggs become embedded in parenchymatous capsules each containing from 3 to 5 ; there are from 30 to 40 capsules in each proglottis, and they extend laterally to the excretory vessels.

(13) **Raillietina (Raillietina) nagpurensis** Moghe, 1925. (Fig. 264.)

From the domestic pigeon; Nagpur, Central Provinces, India. Moghe.

The worm attains a length of from 25 to 27 cm. and a breadth of about 1·9 mm.; it is composed of from 465 to 530 segments, all of which are broader than long. The genital pores are unilateral and are situated near the middle of the lateral margin of the segment, but they vary slightly and may be a little more anterior. There is a well developed genital atrium. The scolex is almost globular and measures about 340 to 380 μ in breadth. The rostellum is armed with about 220 hooks arranged in a double row ; the large hooks measure 19 μ and the small ones 17 μ. The suckers are armed with a single marginal row of hooks, each of which measures about 7 μ. There is no neck.

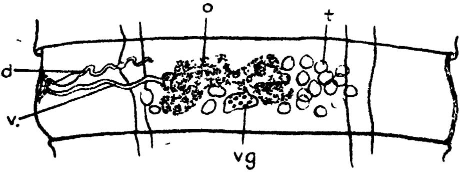


Fig. 264.—*Raillietina (R.) nagpurensis.* Mature segment, × 32. (After Moghe.)

Male Genitalia. There are from 19 to 22 testes which lie laterally and posteriorly to the ovary ; most of them are situated aporally, only two or three being poral and two between the ovary and the vitelline gland. The vas deferens is very short and coiled. The cirrus sac measures about 90 by 30 μ, and does not extend to the longitudinal excretory vessel.

Female Genitalia. The ovary is a large, irregularly lobed organ having a maximum breadth of about 645 μ and placed slightly on the pore side; the vagina opens posteriorly to the cirrus sac. There is a large receptaculum seminis. The vitelline gland is placed centrally, just posteriorly to the ovary, and is of a somewhat irregular shape. The shell gland lies between the vitelline gland and the ovary; there are from 50 to 94 egg-capsules in each segment which do not extend laterally to the excretory vessels. Each capsule contains from 3 to 8 eggs (usually 5 or 6), which latter measure about 50 by 43 μ and the oncosphere 17 by 14 μ.

(14) **Raillietina (Raillietina) quadritesticulata** Moghe, 1925. (Fig. 265.)

From the red turtle-dove (*Œnopopelia tranquebarica*); Nagpur, Central Provinces, India. Moghe.

The worm attains a length of from 6 to 14 cm. and a breadth of 1·23 mm. It is composed of from 188 to 196 segments, all of which are broader than long; the genital apertures are unilateral and situated in the middle of the lateral margin of the segment; there is a well developed genital atrium. The scolex is bluntly rounded and has a breadth of about 165 μ. The rostellum is armed with about 180 hooks, arranged in a double row, the hooks in each row being of the same size, viz., 6 μ. The suckers are armed with about 5 rows of hooks. The neck measures approximately 1 mm. in length.

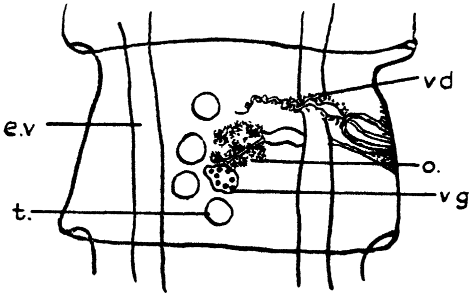


Fig. 265.—*Raillietina (R.) quadritesticulata.* Mature segment, × 47. (After Moghe.)

There are only 4 testes, 3 are situated laterally to the aporal ovary and one posteriorly to the vitelline gland. The vas deferens is a loosely coiled tube. The cirrus sac is muscular; it measures about 138 μ by 68 μ, and does not extend to the longitudinal excretory vessels. The ovary is lobulated and centrally placed. The vitelline gland is posterior to the ovary and slightly aporal. The shell gland is lateral to the ovary and anterior to the vitelline gland. The vagina opens posteriorly to the cirrus sac and ventrally to the excretory vessel. Near the ovary it dilates into a large receptaculum seminis. There are from 40 to 50 egg-capsules in each segment, and they do not extend beyond the longitudinal excretory vessels. Each contains from 6 to 8 eggs, which latter measure 67 by 54 μ and the oncosphere 18 by 16 μ.

(15) **Raillietina (Raillietina) flaccida** Meggitt, 1926. (Fig. 266.)

From the imperial sand-grouse (*Pterocles orientalis*); Victoria Memorial Park, Rangoon. Meggitt.

The worm measures from 13 to 15 cm. in length and has a maximum breadth of 1·2 mm. The genital pores are unilateral and are situated slightly anterior to the middle of the lateral margin of the segment. The rostellum is armed with about 150 hooks arranged in two rows; those in one row measure 17 μ and those in the other 22 μ. The suckers are unarmed.

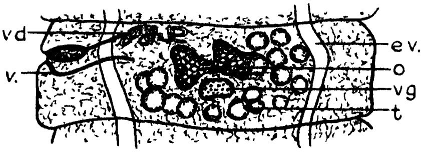


Fig. 266.—*Raillietina (R.) flaccida.* Mature segment, × 53 (After Meggitt, in 'Parasitology.')

Male Genitalia. There are from 14 to 17 testes, 5 of which are poral, the remainder being situated behind the ovary and aporally. The cirrus sac is small, attaining a maximum length of 100 μ and extending to the nerve.

Female Genitalia. The ovary is bilobed, both parts being entire. Each segment contains about 80 egg-capsules which extend laterally to the excretory vessels, and each contains 8 or 9 eggs.

(16) **Raillietina (Raillietina) famosa** Meggitt, 1927. (Fig. 267.)

From the bird *Eclectus pectoralis* (=*Lorius pectoralis*); Victoria Memorial Park, Rangoon. Meggitt.

The worm attains a length of 25 cm. and a maximum breadth of 1·2 mm. The genital pores are unilateral and are situated near the centre of the margin of the segment, a genital atrium being present or absent according to the state of contraction of the segment. The scolex has a diameter of 150 μ and the suckers are unarmed. The rostellum has a diameter of 80 μ and is armed with about 180 hooks, each measuring from 10 to 12 μ.

Male Genitalia. There are from 25 to 29 testes, 6 to 11 of these being aporal and 14 to 18 aporal, The cirrus sac extends to the longitudinal nerve, and has a length of from 110 to 130 μ.

Female Genitalia. These present no special features except that, close to the genital pore, the vagina is very muscular.

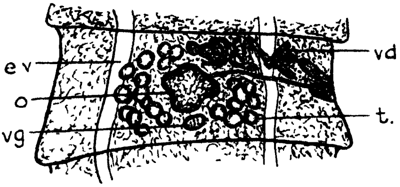


Fig. 267. *Raillietina (R.) famosa.* Mature segment, × 53. (After Meggitt, in 'Parasitology.')

There are from 20 to 38 egg-capsules in each segment, and they extend laterally to the excretory vessels; each contains 2 or 3, and occasionally from 4 to 6 eggs.

(17) **Raillietina (Raillietina) flabralis** Meggitt, 1927. (Fig. 268.)

From the great hornbill, *Dichoceros bicornis*; Victoria Memorial Park, Rangoon. Meggitt.

The worm attains a length of 35 cm. and a maximum breadth of 1 mm. The terminal segments are square; the genital pores are unilateral and are situated at the centre of the margin of the proglottides; genital atrium practically absent. The scolex measures about 216 μ in diameter. The rostellum, which has a diameter of 80 μ, is armed with 350 hooks, each having a length of 6 μ and arranged in two rows. Behind the rostellum there is a spiny collar.

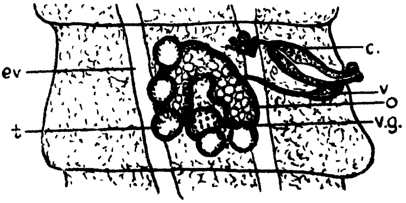


Fig. 268.—*Raillietina (R.) flabralis.* Mature segment, × 80. (After Meggitt, in 'Parasitology.')

Male Genitalia. There are 4 or 5 testes, usually 3 along the posterior margin of the segment and 2 aporally, there being none on the pore side. The cirrus sac attains a maximum length of 120 μ, barely reaching to the excretory vessels, and contains a few coils of the vas deferens and a wide duct which serves as a vesicula seminalis; the end of the cirrus sac is protrusible and the duct capable of evagination, there being no trace, other than this duct, of a cirrus; no spines are found in the cirrus sac.

Female Genitalia. The ovary is horse-shoe-shaped, the concavity being directed posteriorly; it entirely fills the ventral surface between the excretory vessels, except for the space occupied by the vitelline gland. There are from 17 to 23 egg-capsules in two layers in each segment; they do not extend laterally to the excretory vessels; each has a diameter of from 130 to 140 μ and contains 10 eggs.

This species resembles *Raillietina* (*R.*) *quadritesticulata* Moghe, 1925, so closely that the two species are indistinguishable except that in *Raillietina* (*R.*) *flabralis* there is a spiny collar behind the rostellum. Whether such a structure is present in *Raillietina* (*R.*) *quadritesticulata* is not stated, but Meggitt remarks that it is often impossible to see it except in living worms.

(18) **Raillietina (Raillietina) celebensis** var. **paucicapsulata** Meggitt, 1927.

From (1) *Rattus norvegicus* and (2) *Nesocia bengalensis*; Rangoon. Meggitt.

The worm attains a length of 24·2 cm. and a breadth of about 1 mm. The genital pores are unilateral and are situated a little in front of the centre of the lateral margin of the segment. The rostellum has a diameter of from 140 to 170 μ; it is armed with from 100 to 120 hooks, each measuring from 20 to 25 μ in length and arranged in a double crown. Immediately behind the rostellum there is a spiny collar; the suckers are unarmed.

There are from 33 to 35 testes, of which from 11 to 15 are poral and from 20 to 23 are aporal. The cirrus sac measures from 89 to 113 μ by 48 to 65 μ in mature segments and extends to the nerve. There are from 100 to 120 egg-capsules in each segment, a few of which extend laterally to the excretory vessels. Each capsule contains from 3 to 4 eggs. Meggitt states that the "present form agrees closely with *Raillietina* (*Raillietina*) *celebensis* except for the gravid proglottides. In that latter respect the two forms are clearly different...." He does not state, however, in what way they are different.

Subgenus (*b*) *PARONIELLA* Fuhrmann, 1920.

Raillietina **: in which the genital pores are unilateral. Egg-capsules each contain a single oncosphere. Adults in birds and mammals.**

Type-species :—*Raillietina* (*Paroniella*) *longispina* (Fuhrmann, 1909).

It is not possible to give a satisfactory key to the species of this subgenus, but the following table will serve to indicate some of the points of difference between them :—

	Testes.	No. of hooks.	Size of hooks.
urogalli	130	160	15 μ
cruciata	?	200	15 μ
corvina	26	80	16 μ
ceylonica	?	120	10 μ
tragopani	6 or 7	46	10 μ
facile	9	85	11 μ
contorta	2	?	?

(1) **Raillietina (Paroniella) urogalli** (Modeer, 1790) Fuhrmann, 1920. (Fig. 269.)

Synonyms :—*Tænia urogalli* Modeer, 1790.
Tænia calva Baird, 1853.
Davainea calva (Baird, 1853) Stiles, 1896.

From a partridge pheasant (*Alectoris grœcachukar*) ; Zoological Gardens, Calcutta. Southwell.

The worm may attain a length of 35 cm. and a maximum breadth of 4 mm. The genital pores are unilateral and are situated in the anterior third of the lateral margin of the segment. The scolex has a diameter of from 250 to 270 μ. The rostellar bulb has a diameter of from 68 to 88 μ and is armed with a double crown of about 160 hooks, each having a length of from 14 to 16 μ. The suckers are armed ; the neck varies in length from 200 μ to 3 or 4 mm.

Muscular System. This is a well developed and almost fills the entire cortical parenchyna. It consists of groups of bundles irregularly disposed, some of which contain from 2 to 4 fibres and others from 8 to 12. In addition, numbers of single, slender fibres are seen in transverse section, but in gravid segments only solitary fibres are found. The transverse muscles are disposed peculiarly ; unlike what occurs in many cestodes, they do not separate the cortical from the medullary parenchyma, but are distributed between the inner longitudinal fibres.

Excretory System. Apparently there is only one longitudinal vessel on each side, viz., the ventral vessel. It measures from 60 to 80 μ in diameter. The transverse vessel in each segment is wider than the longitudinal one.

Male Genitalia. There are at least 130 testes in each segment, this being the only species of *Raillietina* possessing such a large number ; they surround the female glands. On the poral side there are from 28 to 36, whilst aporally there are from 84 to 100. The vas deferens is much coiled ; it runs parallel to the anterior margin of the segment to the level of the ovary an[illegible]urrounded with prostatic cells. The cirrus sac is small and pyriform, measuring only from 110 to 120 μ. The cirrus is armed.

Female Genitalia. The ovary is bilobed and lies slightly on the poral side ; it measures from 440 to 500 μ in breadth ; each half is further subdivided into a number of secondary lobes. The vagina opens posteriorly to the cirrus sac ; its terminal part is muscular and its lumen bears a number of silky hairs. The muscular termination of the vagina extends internally to the nerve and passes between the excretory vessels ; it continues in the median direction almost directly to the female genital organs. Its main part functions as a receptaculum seminis. The vitelline gland is situated behind the ovary ; it is slightly lobed and has a breadth of about 130 μ. The shell gland is very small and is situated dorsally to the middle of the ovary. The uterus is dorsal and slightly anterior to the ovary, resembling the latter in shape, *i. e.*, it consists at first of a central cavity with radiating lobes. The latter extend into the medullary parenchyma ; their walls eventually disappear and the eggs come to rest in the parenchyma. In gravid segments they lie singly in capsules which do not extend laterally to the excretory vessels. The oncosphere measures from 24 to 30 μ and the capsule has a diameter of about 68 μ.

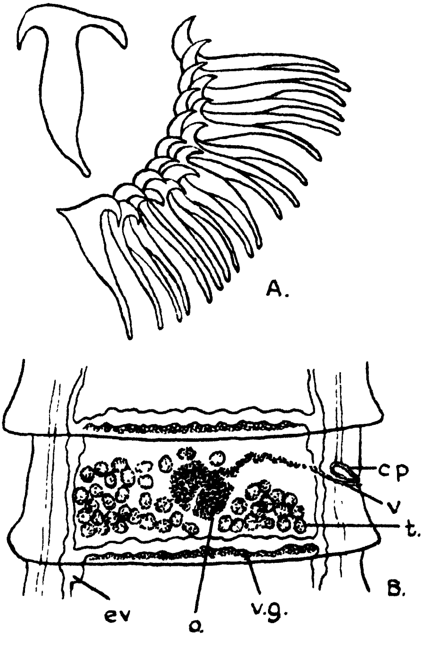


Fig. 269.—*Raillietina (Paroniella) urogalli.* A, rostellar hooks ; B, mature segment, magnification unknown. (After Shipley.)

(2) **Raillietina (Paroniella) cruciata** (Rudolphi, 1819).

From a magpie (*Pica rustica*); Zoological Gardens, Calcutta. Southwell.

A single specimen with unilateral pores, believed to be referable to the above species, has been recorded. The rostellum is armed with about 200 hooks, each measuring about 15 μ, and arranged in a double row. The suckers are armed with minute hooklets. Each egg-capsule contains a single egg.

(3) **Raillietina (Paroniella) corvina** (Fuhrmann, 1905). (Fig. 270.)

Synonym:—*Davainea polycalcaria* Linstow, 1906.

From (1) *Corvus macrorhynchus*; Colombo, Ceylon. Southwell. Calcutta; Sabour, Bihar, India. Southwell. (2) *Corvus splendens*; Calcutta. Southwell. (3) *Corvus* sp.; Khulna, Bengal; and Chilka Lake, Orissa, India. Southwell.

The worm attains a length of 12 cm. and a breadth of from 2 to 3 mm. The unilateral genital pores are situated near the middle of the lateral margin of the segment; all the latter are broader than long. The rostellum is armed with about 80 hooks, each measuring from 16 to 18 μ in length. The suckers are armed with from 5 to 6 rows of hooks; each hook measures about 9 μ. The testes are numerous (about 26) and are situated in two groups, one on each side of the ovary. The vas deferens is much coiled, and runs parallel and anteriorly to the vagina. The cirrus sac is extremely small, measuring 100 μ in length by 40 μ in breadth, and only extending about one-third the distance between the margin of the segment and the nerve; the cirrus is unarmed. The ovary is situated in the middle line and consists of a number of tubule-like follicles, arranged fanwise. Immediately behind it is a small vitelline gland presenting a granular appearance; the vagina opens to the genital atrium posteriorly to the cirrus sac; its terminal part, viz., that lying between the pore and the nerve, is surrounded by cells. It continues in the median direction

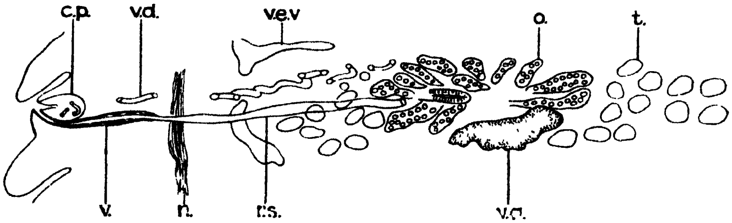


Fig. 270. —*Raillietina (Paroniella) corvina.* Horizontal section of mature segment, magnification unknown. (After Fuhrmann.)

as a straight tube which, internally to the nerve, dilates a little and functions as a receptaculum seminis. The uterus breaks up into capsules, each of which contains a single egg.

(4) **Raillietina (Paroniella) ceylonica** (Baczyńska, 1914). (Fig. 271.)

From (1) *Crocopus phœnicopterus*; Zoological Gardens, Calcutta, and Chilka Lake, Orissa, India. Southwell. (2) The white-bellied pigeon (*Columba leuconata*); Zoological Gardens, Calcutta. Southwell. (3) *Pavo cristatus*; Ceylon. Fuhrmann.

The worm attains a length of from 3 to 4 cm. and a breadth of 1·3 mm. All the segments are broader than long; the gravid ones have a length of 730 μ and a breadth of 1·98 mm. The genital pores are unilateral and are situated in the anterior third of the lateral margin of the segment. The head has a diameter of 400 μ; the rostellum is armed with about 120 hooks arranged in a double row, each hook measuring about 10 μ. The suckers are armed with minute spines.

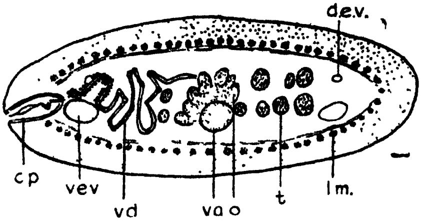


Fig. 271.—*Raillietina (Paroniella) ceylonica.* Transverse section of mature segment, magnification unknown. (After Baczyńska.)

The longitudinal muscles consist of a single layer of rather large and conspicuous bundles. Externally to them there are numerous small groups of fibres. The transverse and dorso-ventral musculatures are poorly developed. The ventral excretory vessel is very much larger than the dorsal one. The testes are few in number, and are disposed to the left and to the right of the female genital organs. Each testis has a diameter of about 50 μ. The cirrus sac is pyriform and almost cylindrical; it barely reaches the excretory canal, and has a length of 130 μ and a breadth of 31 μ. The cirrus is muscular. The vas deferens is very undulated, and is surrounded by a number of pigmented glandular cells; within the cirrus sac it is thrown into slight undulations. The ovary is in the middle of the segment; it is deeply lobed and has a length of 192 μ and a breadth of 256 μ. Immediately ventral to it is the vitelline gland, which has a length of 78 μ and a breadth of 91 μ. The shell gland, which has a diameter of 39 μ, is situated dorsally to the vitelline gland. The vagina opens posteriorly and ventrally to the cirrus sac, and is a long canal thrown into undulations. The receptaculum seminis has a length of 86 μ; the egg-capsules each contain from 6 to 10 eggs; each has a diameter of 192 μ, and they extend laterally to the excretory vessels. The egg measures 28 μ and the oncosphere 18 μ.

(5) **Raillietina (Paroniella) tragopani** (Southwell, 1922). (Fig. 272.)

From a tragopan pheasant (*Tragopan* sp.); Zoological Gardens, Calcutta. Southwell.

The worm measures 8·5 mm. in length and its greatest breadth is 600 μ. It is composed of 27 or 28 segments; the last one measuring 825 μ in length and 600 μ in breadth. The genital pores are unilateral and are situated a little anterior to the middle of the lateral margin of the segment. The head has a length of 125 μ and a breadth of 180 μ. The total number of hooks is about 46, and they are apparently in a single row; each measures about 10 μ in length. The suckers are armed with from 4 to 6 rows of hooks. The neck has a length of about 300 μ.

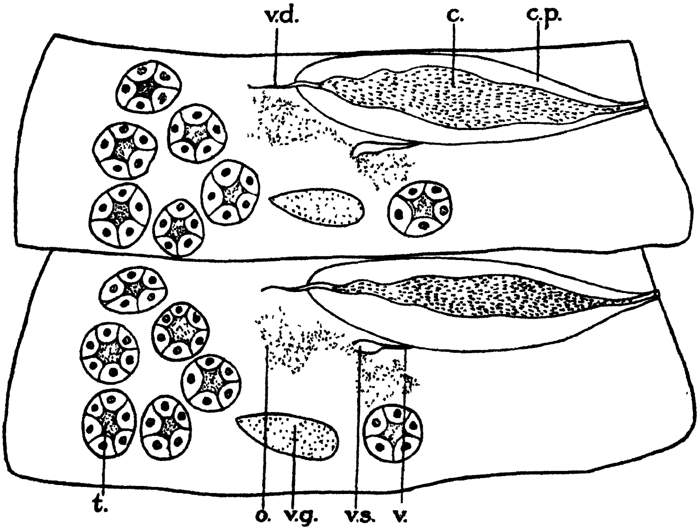


Fig. 272.—*Raillietina (Paroniella) tragopani.* Mature segments, × 210. (After Southwell.)

There are 6 or 7 testes in each segment, and they first appear in about segment 4. When fully mature they measure about 70 μ. Usually there are four situated aporally, one or two posteriorly to the ovary, and a single testis on the pore side, behind the internal extremity of the cirrus. The cirrus sac, when fully developed, extends at least halfway across the segment, and has very thick (? muscular) walls. In segment 17 it measures 250 μ in length and 110 μ in breadth; it persists to the last segment. The cirrus is peculiar in being a greatly dilated organ densely covered with minute spines, and almost filling the cirrus sac. The vas deferens is short and slightly coiled; seminal vesicle apparently absent.

The ovary, which first appears in about segment 8, is definitely bilobed, each half being globular, 70 μ in diameter, and composed of a number of rounded acini. From the pore the vagina pursues a direct course to the mid-ovarian region, where it dilates into a receptaculum seminis. The vitelline gland lies posteriorly to the ovary and is a conspicuous organ. In full development it has a diameter of about 60 μ. The uterus first appears as a small cavity immediately anterior to and between the two lobes of the ovary. It enlarges and eventually single eggs become isolated in the parenchyma. In the last few segments no trace of the excretory vessels can be seen; it is therefore impossible to say definitely whether the eggs extend beyond them or not. But, as there is a clear area between the edge of the segment and the eggs, it would appear that the latter lie internally to the excretory vessels. The egg has a diameter of about 54 μ and the oncosphere of 25 μ.

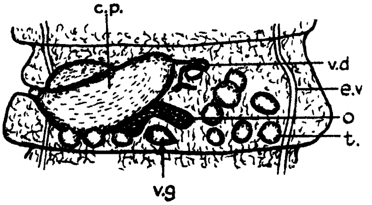


Fig. 273.—*Raillietina (Paroniella) facile.* Mature segment, × 107. (After Meggitt, in 'Parasitology.')

(6) Raillietina (Paroniella) facilis Meggitt, 1926. (Fig. 273.)

From the pheasant *Tragopan satyra*; Rangoon, Burma. Meggitt.

The worm attains a length of 4 mm. and a breadth of 700 μ, and is composed of from 15 to 20 segments. The genital pores are unilateral and are situated in the centre of the margin of the proglottis at the bottom of a shallow genital atrium. The rostellum is armed with a single row of 85 hooks, each having a length of from 10·3 to 12 μ. The suckers are armed with deciduous hooks varying in length from 9 to 11 μ, apparently arranged in from 3 to 4 rows.

Male Genitalia. There are 9 testes in each segment (10 figured), three of these being poral and the remainder aporal; they are lateral to the female glands. The cirrus sac is very large and is the most conspicuous structure in the segment. It measures about 180 by 80 μ and in young proglottides extends beyond the centre. The cirrus is armed.

Female Genitalia. The ovary is slightly poral, small and bilobed, each half being entire. The vagina is marked by a swelling almost as large as the cirrus sac, situated near the genital pore. The eggs lie singly in capsules which do not extend beyond the excretory vessels, but otherwise entirely fill the segment *.

Subgenus (*c*) *SKRJABINIA* Fuhrmann, 1920.

Raillietina: in which the genital pores are irregularly alternate and in which the egg-capsules each contain a single egg. Type-species:—*Raillietina* (*Skrjabinia*) *cesticillus* (Molin, 1858).

Key to Species.

Suckers armed	*S. centropi*, p. 98.
Suckers unarmed	*S. cesticillus*, p. 97.

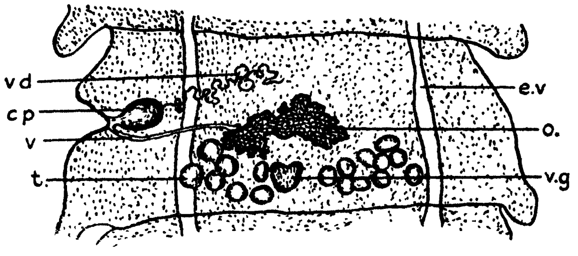


Fig. 274.—***Raillietina* (*Skrjabinia*) *cesticillus*. Mature segment, × 40. (After Meggitt.)**

(1) Raillietina (Skrjabinia) cesticillus (Molin, 1858). (Fig. 274.)

Synonym:—*Tænia cesticillus*, Molin, 1858.

From (1) The domestic fowl; Berhampur, Bengal. Southwell. Burma. Meggitt. (2) *Gallus sonnerati*; Zoological Gardens, Calcutta. Southwell.

*** (7) *Raillietina* (*Paroniella*) *contorta* Zschokke, 1895. From the common Indian Pangolin (*Manis pentadactyla*). This worm measures from 4 to 8 cm. in length, and is differentiated by possessing two testes only.**

The worm attains a maximum length of 13 cm. and a breadth of 3 mm. The genital pores are irregularly alternate and are situated in the anterior third of the margin of the segment. The rostellum is armed with from 400 to 500 hooks, each from 7 to 12 μ in length and arranged in two rows ; the suckers are unarmed. There are from 20 to 30 testes ; the cirrus sac extends median to the excretory vessels. The egg-capsules extend laterally as far as the excretory vessels and each contains a single egg. The larvæ occur in *Musca domestica* and in the ground beetle *Calathus opaculus.*

(2) **Raillietina (Skrjabinia) centropi** (Southwell, 1922). (Fig. 275.)

From the common caccal (*Centropus rufipennis*) ; Lake Tamblegam, Ceylon. Southwell.

The worm measures from 2·5 cm. in length and has a maximum breadth of about 1·5 mm. The segments are very much broader than long, all except a few at the posterior extremity being quite short. Their lateral posterior margins are salient. The genital pores are irregularly alternate, being situated and directed anteriorly. The head is prominent and presents a truncated appearance ; it measures about 300 μ in breadth and merges into a very short neck. The suckers have a diameter of about 300 μ, and bear on their margins about 15 rows of hooks, each measuring about 8 μ. The rostellum is relatively small and is armed with about 300 hooks, each 9 to 11 μ in length, and arranged in a double row.

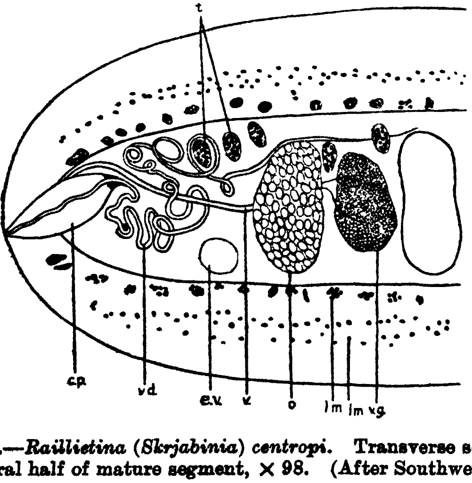


Fig. 275.—*Raillietina (Skrjabinia) centropi.* Transverse section of poral half of mature segment, × 98. (After Southwell.)

The muscular system is poorly developed ; the longitudinal fibres are relatively scanty and consist of small bundles somewhat widely separated, which decrease in size externally. The transverse muscles lie internally to the longitudinal muscles and are also not very numerous ; oblique or dorso-ventral fibres are few. A small single nerve-strand is situated laterally to the ventral excretory vessel on each side. On the pore side the nerve is ventral to the cirrus sac and the vagina.

The excretory system consists of a single ventral vessel on each side ; on the pore side it lies ventrally to the cirrus sac.

The testes are about 40 in number ; they are situated antero-dorsally on each side of the ovary, and extend laterally to the ventral excretory vessels. They are somewhat oval in shape and, when fully developed, measure about 85 by 55 μ. The vas deferens is remarkably long. It extends halfway across the segment, and is thrown into a large number of loops which occupy almost the entire field between the internal extremity of the cirrus sac and the poral wing of the ovary. Seminal vesicles apparently absent. The cirrus varies in length, extending from about half to three-quarters the distance between the lateral margin and the ventral excretory vessel.

The ovary is a relatively large bilobed organ situated postero-ventrally ; in full development it extends almost to the dorsal transverse muscle-fibres. From the pore the vagina runs dorsally to the cirrus sac ; at the internal extremity of the latter organ it curves gradually and runs directly to the ovary. It is muscular throughout its length ; its internal extremity is dilated into a muscular receptaculum seminis which, when fully developed, measures about 150 μ in length and 50 μ in breadth. The oviduct, vitelline duct, and fertilization canal are also noticeable on account of their length. The vitelline gland lies ventrally to, and between, the two lobes of the ovary ; it is large and easily seen. When fully developed, the uterus extends laterally to the ventral excretory vessels, and consists of a large number of parenchymatous capsules, each containing a single egg. The latter has a diameter of about 55 μ and the oncosphere about 36 μ.

Subgenus (*d*) *FUHRMANNETTA* Stiles & Orleman, 1926 (=*Johnstonia* Fuhrmann, 1920).

Raillietina : in which the genital pores are irregularly alternate, and in which the egg-capsules each contain several oncospheres. Type-species :—*Raillietina* (*Fuhrmannetta*) *crassula* (Rudophi, 1819).

Key to Species.

1.	Rostellum with a collar armed with spines.	2.
	Rostellum without a collar armed with spines	3.
2.	Egg-capsules extending laterally to excretory vessels	*F. pseudoechinobothrida,* [p. 101.
	Egg-capsules not extending laterally to excretory vessels	*F. birmanica,* p. 101.
3.	Rostellum armed with 200 hooks measuring 12 to 13 μ	*F. echinobothrida,* p. 100.
	Rostellum armed with 170 hooks measuring 18 to 20 μ	*F. korkei,* p. 102.

(1) **Raillietina (Fuhrmannetta) echinobothrida** (Mégnin, 1880). (Fig. 276.)

Synonyms:—*Tænia echinobothrida* Mégnin, 1880.
Tænia botrioplites Piana, 1881.
Davainea parechinobothrida Magelhaes, 1898.

From (1) The domestic fowl; Berhampur, Bengal. Southwell. Burma. Meggitt. (2) Jungle-fowl (*Gallus bankiva*); Berhampur, Bengal. Southwell. (3) *Gallus ferrugineus*; Zoological Gardens, Calcutta. Southwell.

The worm attains a length of 25 cm. and a maximum breadth of 4 mm. The genital pores are irregularly alternate and are situated in the posterior half of the margin of the segment. The rostellum is armed with about 200 hooks arranged in two rows, each measuring from 10 to 13 μ. The suckers are armed with from 8 to 10 rows of hooks, which vary in size from 6 to 15 μ. There are from 20 to 30 testes; the cirrus sac, which measures from 13 to 18 μ, does not reach to the longitudinal excretory vessels. The egg-capsules extend laterally to the excretory vessels and each contains from 6 to 12 eggs. The latter vary in size from 25 to 50 μ. Larval forms in *Helix maculosa*.

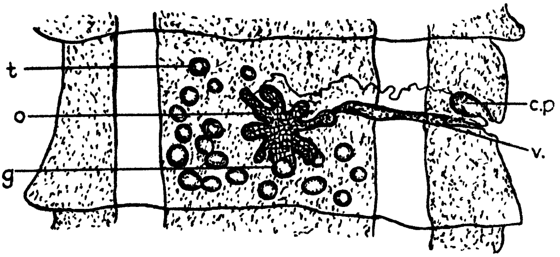


Fig. 276.—*Raillietina (Fuhrmannetta) echinobothrida.* Mature segment, × 53. (After Meggitt.)

(2) **Raillietina (Fuhrmannetta) pseudoechinobothrida** Meggitt, 1926.

From the domestic fowl; Burma. Meggitt.

The worm measures from 8 to 9 cm. in length and has a breadth of 1·8 mm. The genital pores are irregularly alternate, and are situated in the posterior half of the lateral margin of the segment. The rostellum is armed with about 200 hooks varying in size from 8 to 12 μ and arranged in two rows. Immediately posterior to the rostellum there is a collar thickly studded with minute spines. It is not known whether the suckers are armed or not.

There are from 30 to 50 testes, and the cirrus sac does not reach to the longitudinal excretory vessels. The egg-capsules extend laterally to the longitudinal excretory vessels, and each contains 3 or 4 eggs. The species is closely related to *R. echinobothrida*, from which it differs in having a larger number of testes and fewer eggs in each capsule.

(3) **Raillietina (Fuhrmannetta) birmanica** Meggitt, 1926. (Fig. 277.)

From the domestic fowl; Burma. Meggitt.

The worm measures from 8 to 10 mm. in length and has a breadth of from 1 to 2 mm. The genital pores are irregularly alternate and are situated in the anterior half of the margin of the segment. The rostellum is armed with about 300 hooks arranged in two rows, the large ones measuring 12 μ and the small ones 9 μ. Immediately behind the rostellum there is a collar thickly studded with minute spines similar to that which occurs in *R. torquata* and *R. frontina*. It should be noted, however, that this collar is only visible in living worms. The suckers are unarmed.

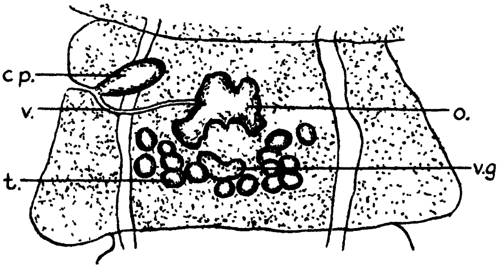


Fig. 277.—*Raillietina (Fuhrmannetta) birmanica*. Mature segment, × 53. (After Meggitt.)

There are from 20 to 25 testes in two lateral groups connected by a single posterior row, the aporal row being the larger. The cirrus pouch is large and extends median to the excretory vessel. The egg-capsules each contain several eggs, and do not extend laterally to the excretory vessels.

(4) **Raillietina (Fuhrmannetta) korkei** Joyeux & Houdemer, 1928. (Fig. 278.)

From pigeons; Kasauli, India.

The gravid worm measures 164 mm. in length and has a breadth of 2 mm. The genital pores are apparently irregularly alternate. The scolex has a length of 175 μ and a breadth of 200 μ; the rostellum is dome-shaped, 85 μ in height, and 120 to 130 μ in breadth. It bears 150 to 160 hammer-shaped hooks, each measuring from 18 to 20 μ in length and clearly placed in a double row. The suckers have a diameter of from 60 to 70 μ and are armed with several rows of spines, the smaller ones being deciduous; they vary in size, the largest being 10 μ. The neck has a length of 6 or 7 mm. The musculature is well developed; the longitudinal fibres are numerous, sometimes in three or four layers. The transverse muscles consist of three or four concentric fibres. The dorso-ventral muscles are composed of numerous fine fibres ramifying through the entire cortical parenchyma.

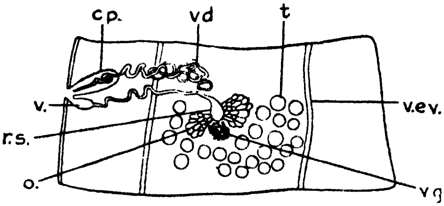


Fig. 278.—*Raillietina (Fuhrmannetta) korkei.* Mature segment, magnification unknown. (After Joyeux and Houdemer.)

There are 24 testes, 17 being aporal and 7 poral; each measures 35 μ in diameter. Seminal vesicle present on coiled vas deferens. The cirrus sac measures about 110 μ and does not reach the ventral vessel, and there is no internal seminal vesicle. The cirrus is unarmed.

The vagina is posterior to the male orifice and is short and wide; a receptaculum seminis is present. There are from 50 to 66 egg-capsules in each segment, extending laterally to the excretory vessels. Each measures 170 μ and contains from 6 to 9 eggs, which are 18 by 14 μ in diameter.

The following species of *Raillietina* cannot be placed in any of the above subgenera owing to our lack of knowledge of anatomical details concerning them :—

(1) **Raillietina anatina** (Fuhrmann, 1909).

From (1) pigeons (*Columba* sp.) and (2) the green pigeon (*Crocopus phœnicopterus*), both from Chilka Lake, Orissa, India. Southwell.

Fully mature worms have not been described ; the worm attains a length of 1·5 cm. and a breadth of 1·5 mm. The genital pores are regularly alternate. The scolex has a diameter of from 400 to 500 μ. The rostellum, which has a breadth of from 160 to 200 μ, is armed with about 300 hooks, each measuring from 14 to 16 μ in length and arranged in a double row. The suckers are unarmed. There are from 16 to 18 testes.

(2) **Raillietina reynoldsæ** Meggitt, 1926. (Fig. 279.)

From *Corvus splendens insolens* ; Rangoon. Meggitt.

The worm attains a length of 25 cm. and a maximum breadth of 300 μ. The genital pores are situated at the anterior third of the margin of the proglottis. The scolex has a diameter of 380 μ and the rostellum 110 μ. The latter is armed with a double circle of hooks, about 250 in all, each measuring from 11 to 17 μ in length. Surrounding the rostellum there is a spiny collar 180 to 210 μ in diameter. The suckers are armed with five rows of hooks which diminish in size towards the centre of the sucker.

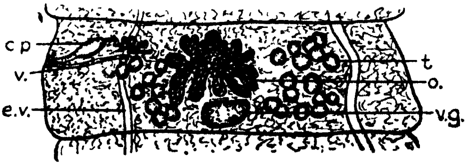


Fig. 279.—*Raillietina reynoldsæ*. Mature segment, × 40. (After Meggitt, in 'Parasitology.')

Male Genitalia. The testes are clearly separated into two groups, from 7 to 12 being poral and 26 to 27 aporal. The cirrus sac measures from 130 to 212 μ in length, increasing in size posteriorly. Having regard to the wide range in size of this organ, Meggitt states that "measurements without mention of maximum size and portion of body are useless," and with this remark the writer agrees. The cirrus sac crosses the nerve, but does not reach the excretory vessel, this character being more constant than the size of the organ.

Female Genitalia. The ovary is much lobed; the egg-capsules each contain a single egg and extend laterally to the excretory vessels; in gravid segments they reach to the subcuticula.

This species is closely related to *Raillietina* (*Paroniella*) *corvina* (Fuhrmann, 1905), from which it differs, however, in the greater number and smaller size of the rostellar hooks and also in the large size of the cirrus sac.

Meggitt points out that: "In one crow containing numerous examples of this species, the wall of the posterior portion of the intestine was studded with numerous small tubules, 3 mm. in diameter, some level with and hardly to be distinguished from the intestine, others spherical or ellipsoidal and only attached to it by thin threads. The former contained scoleces of *T. reynoldsæ*, entirely separated from the lumen of the intestine and from any strobila. The latter were extremely tough, consisting of several strata surrounding a central cavity containing pus and a larval tapeworm. The tapeworm was solid, containing a few calcareous corpuscles and numerous oil globules, a few brown, but the majority colourless; scolex hooks were entirely absent. The penetration of cestode scoleces into the intestinal wall has already been recorded in the cases of *Raillietina* (*Fuhrmannetta*) *echinobothrida* (Mégnin, 1880) and *R. penetrans* (Baczynska, 1914). No record exists of any larval form in the intestinal wall of birds."

(3) **Raillietina fatalis** Meggitt, 1927.

From (1) *Nesocia bengalensis* and (2) *Rattus norvegicus*; Rangoon. Meggitt.

The worm attains a length of 19 cm. and a breadth of 4·5 mm. All the segments are broader than long, the strobila being somewhat pointed posteriorly. It is not known whether the genital pores are unilateral or irregularly alternate. The scolex may attain a diameter of 600 μ. The rostellum has a breadth of from 140 to 170 μ, with about 180 hooks, each measuring from 23 to 32 μ in length and arranged in a double row. Immediately behind the rostellum there is a spiny collar. The suckers are armed with about 6 rows of hooks, each hook measuring about 4 μ.

A ventral excretory plexus is present with three or four long vessels. According to Meggitt, there are from 38 to 43 testes of which from 15 to 26 are aporal and 13 to 22 poral. They are situated mostly between the two outermost longitudinal excretory vessels. The cirrus sac measures about 105 by 70 μ in immature segments, and does not reach the nerve. The egg-capsules are too numerous to count, being extremely small and tightly packed together; they extend laterally to the excretory vessels and nerve, and each contains a single egg, so that a gravid proglottid presents a granular appearance in whole mounts.

(4) **Raillietina fluxa** Meggitt, 1927.

From *Rattus norvegicus*; Rangoon. Meggitt.

The worm attains a length of 1·3 cm. and a breadth of 1 mm. The genital pores are irregularly alternate. The scolex has a diameter of about 626 μ and the rostellum of 195 μ; the latter is armed with about 156 hooks, each from 18 to 22 μ in length and arranged in a double row. Immediately behind the rostellum there is a spiny collar. The suckers are unarmed. There are from 19 to 21 testes, of which 7 are poral and from 12 to 14 aporal. Gravid segments unknown.

(5) **Raillietina funebris** Meggitt, 1927.

From *Rattus norvegicus*; Rangoon. Meggitt.

The worm attains a length of 3 cm. and a breadth of 760 μ. The genital pores are unilateral and are situated at the anterior third of the lateral margin of the segment. The scolex has a diameter of from 410 to 580 μ and the rostellum from 105 to 171 μ; the latter is armed with from 80 to 100 hooks, each measuring from 17 to 21 μ in length and arranged in a double row. The suckers are unarmed. There are from 35 to 40 testes surrounding the female glands on all sides except dorsally and in the space occupied by the genital ducts. The cirrus sac measures from 105 to 121 μ by from 48 to 54 μ, and extends just median to the nerve in young segments and to the excretory vessels when mature; gravid segments are unknown.

The species is closely related to *R. madagascariensis* and *R. gracilis.* It differs from both in the absence of acetabular hooks, from *R. madagascariensis* in having fewer testes, and from *R. gracilis* in the position of the genital pore.

(6) **Raillietina indica** Meggitt, 1927.

From *Nesocia bengalensis*; Rangoon. Meggitt.

This species was described from a single immature specimen, the size of which is not stated. The genital pores are irregularly alternate. The scolex has a diameter of 820 μ and the rostellum of 240 μ; the latter is armed with from 250 to 260 hooks, each measuring from 22 to 25 μ and arranged in a double row. Immediately behind the rostellum there is a spiny collar. The suckers are armed with from about 6 to 7 rows of hooks diminishing in size internally and measuring about 2 or 3 μ.

SPECIES INQUIRENDÆ.

(1) **Raillietina** sp. Southwell, 1922.

From pigeons (*Columba* sp.); Berhampur, Bengal. Southwell.

A fragment without a head was obtained from this host.

(2) **Raillietina** sp. Southwell, 1922.

From pigeons (*Columba* sp.); Berhampur, Bengal. Southwell.

This second species, also without a head, from the same host, measured 15 cm. in length and 3 mm. in breadth; the egg-capsules extended laterally to the excretory vessels, and each contained three or four eggs.

It is impossible to determine the species to which the above two specimens belong.

(3) **Raillietina** sp. Southwell, 1922.

From a crow pheasant; Zoological Gardens, Calcutta. Southwell.

A few fragments without heads.

(4) **Raillietina** sp. Meggitt, 1926.

From *Gallus ferrugineus*; Victoria Memorial Park, Rangoon. Meggitt.

The worm attains a length of 8 mm. and a breadth of 300 μ; it contains about 30 proglottides, the terminal ones being longer than broad; all the segments are either immature or sterile, *i. e.*, devoid of any trace of genital organs.

The scolex measures 190 μ in diameter; the rostellum, which has a diameter of 43 μ, is armed with a single crown of about 100 hooks, which measure from 11 to 13 μ; the suckers are unarmed. Meggitt points out that no species of this genus possessing these characters has been recorded from Galliformes, and only *R. columbæ* (Fuhrmann, 1908) from birds in general; but, having regard to the scanty information available regarding this worm, he deemed it inadvisable to create a new species.

(5) **Raillietina** sp. (? **paradisea** Fuhrmann, 1908).

From pigeons; Zoological Gardens, Calcutta. Southwell.

A single specimen, consisting of a head and a few anterior segments, was obtained. The rostellar hooks were in a double row, each hook measuring about 23 μ. Apparently the only species with hooks approximately of this size are *D. paradisea* Fuhrmann, 1908, and *D. conopophilæ* Johnston, 1911. The identity of the parasite is, however, quite uncertain.

(6) Moghe (1926) records undetermined species of *Raillietina* from (1) the domestic fowl, (2) *Cypselus affinis*, and (3) *Turtur cambayensis*; India.

Genus IV. COTUGNIA Diamare, 1893.

Segments are broader than long. A double set of reproductive organs in each proglottis close to the longitudinal excretory canals. Genital ducts pass dorsally to the longitudinal excretory vessels and nerve. Testes numerous, generally posterior, and extending laterally to the extreme edge of the medullary parenchyma. Uterus breaks down and eggs become enclosed singly in egg-capsules. Adults in birds.

Type-species :—*Cotugnia digonophora* (Pasquale, 1890).

Key to Species.

1. Rostellum much smaller than suckers.	*C. margareta*, p. 110.
Rostellum approximating in size to suckers	2.
2. Rostellum armed with a single row of hooks	*C. digonophora*, p. 107.
Rostellum armed with a double row of hooks	3.
3. Hooks alternately of two different sizes.	
a. Posterior segments longer than broad ; musculature weakly developed	*C. cuneata* var. *tenuis*, p. 112.
b. Posterior segments broader than long ; musculature strongly developed	*C. cuneata* var. *nervosa*, p. 113.
Hooks all of one size	4.
4. Hooks not more than 12 μ length	5.
Hooks more than 12 μ in length	6.
5. Testes extending laterally to excretory vessels	*C. brotogerys*, p. 109.
Testes rarely extending to excretory vessels	*C. seni*, p. 113.
6. Suckers unarmed	*C. fastigata*, p. 111.
Suckers armed	*C. fuhrmanni*, p. 108.

(1) **Cotugnia digonophora** (Pasquale, 1890). (Fig. 280.)

Synonyms :—*Tænia digonophora* Pasquale, 1890.
Cotugnia ? bifaria Southwell, 1922.

From (1) Ducks ; Zoological Gardens, Calcutta. Southwell. (2) Domestic fowl ; Berhampur, Bengal. Southwell. (3) Somett's jungle fowl ; Victoria Memorial Park, Rangoon. Meggitt.

The worm attains a maximum length of about 8 cm. and a breadth of 8 mm. It has a thickness of about 1 mm. The head measures about 1·4 by 1·1 mm. ; the rostellum bears an enormous number of minute hooks arranged in a single row, each hook measuring about 8 μ. The suckers are cup-shaped, prominent, and have a diameter of about 450 μ. The neck is short or absent. The anterior segments are broader than long, but they gradually elongate and the posterior ones are longer than broad. The genital pores are double in each segment, and are situated about the middle of the lateral margin. Each segment contains a double set of genital organs.

The cirrus sacs are cylindrical, and extend about half the distance between the lateral margin of the segment and the excretory vessels on each side. The vas deferens is thrown into a number of loose coils in front of each ovary in the vicinity of these vessels.

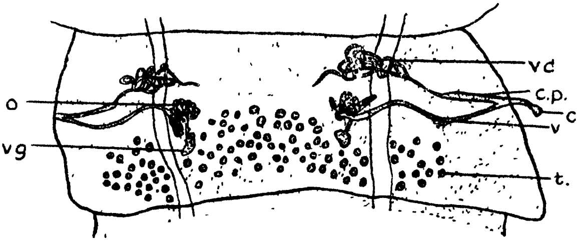


Fig. 280.—*Cotugnia digonophora.* Mature segment, × 175. (After Meggitt.)

There are about 100 testes situated posteriorly to the ovaries, extending in a single broad field laterally to the excretory vessels on each side.

There are two ovaries in each segment, one being situated just median to each excretory vessel, and behind each there is a conspicuous vitelline gland. The egg measures about 60 μ.

(2) **Cotugnia fuhrmanni** Baczyńska. (Fig. 281.)

From *Pavo cristatus* ; Ceylon. Fuhrmann's Collection.

The worm attains a length of from 6 to 8 cm. and a breadth of 2·5 mm. All the segments are broader than long ; the mature ones measure 390 μ in length and 1·78 mm. in breadth. The genital pores are double in each segment and are situated in the middle third of the lateral margin. The scolex has a length of 400 μ and a breadth of 560 μ. The suckers have a diameter of about 180 μ and their margins are armed with numerous minute hooks. The rostellum has a breadth of 86 μ and bears about 170 hooks, each having a length of about 15 μ, and arranged in a double row.

The longitudinal muscles are distributed in two layers of bundles, the inner ones being much more strongly developed than the outer. The transverse muscles are also well developed, and consist of three layers, viz., one internally to the internal longitudinal bundles, another between the inner and outer, and the third externally to the outer longitudinal bundles. In addition, isolated fibres occur in the cortex ; the musculature thus resembles that found in species of the subfamily Acoleinæ. The excretory vessels are situated a considerable distance from the lateral margin of the segment.

There are from 60 to 70 testes in each segment, occupying the posterior part and extending laterally to the excretory vessels. They are absent in the anterior part. The undulations of the vas deferens are surrounded by glandular prostatic cells. The cirrus sac is narrow and elongated, presenting a tubular appearance ; it has a length of 470 μ and a breadth of 39 μ, and extends slightly median to the excretory vessels. The cirrus is very muscular.

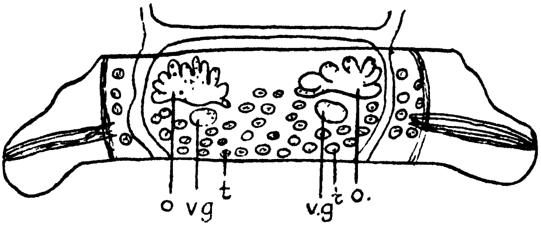


Fig. 281.—*Cotugnia fuhrmanni.* Mature segment, magnification unknown. (After Baczyńska.)

Each ovary is strongly lobed and has a length of 65 μ and a breadth of 185 μ ; the lateral margin of each almost touches the excretory vessels. The vitelline gland has a length of 90 μ and a breadth of 400 μ ; it lies posteriorly and ventrally to the ovary. The shell gland is dorsal to the vitelline gland ; it has a diameter of 78 μ. The vagina opens into the genital atrium anteriorly and ventrally to the cirrus sac ; its course is somewhat undulated ; median to the excretory vessel it dilates into a small fusiform receptaculum seminis, which has a length of about 170 μ. The terminal (lateral) part of the vagina is surrounded with glandular cells. The uterus is at first a simple sac situated dorsally ; later, its walls disappear and the eggs become isolated in the parenchyma. Capsules are formed, each containing a single egg ; they extend laterally to the excretory vessels. Fully mature eggs are not known.

(3) **Cotugnia brotogerys** Meggitt, 1915.

From *Platycercus eximius* ; Rangoon. Meggitt.

The worm attains a length of 7·5 cm. and a maximum breadth of 2 mm. The mature segments measure about 1·55 mm. in length and 1·77 mm, in breadth ; gravid segments have a length of 1·72 mm. and a breadth of about 2·57 mm. The posterior margin of each segment overlaps the anterior margin of the succeeding segment, slightly anteriorly and to an increasing extent posteriorly. The genital pores are situated in the anterior third of the lateral margins of the segment. The head is almost spherical and has a diameter of about 430 μ; the rostellum has a diameter of 150 μ, and is armed with numerous hooks arranged in a double row, each having a length of about 12 μ. The musculature consists of three longitudinal layers which alternate with three layers of transverse fibres.

The testes are numerous, in a double row, occupy the centre of the segment, and extend laterally to the excretory vessels. The cirrus sac is small and reaches to the longitudinal excretory vessels. The ovary consists of a number of short thick lobes arranged fanwise. The vitelline gland is a slightly lobed organ 66 μ in length and 113 μ in breadth, consisting of a number of follicles surrounding a cavity; it lies posteriorly to the ovary. The vagina opens into a genital atrium; it runs postero-transversely, bending once or twice, and dilates just internally to the longitudinal excretory vessel into a large spherical receptaculum seminis. The uterus is not persistent, the eggs becoming enclosed in capsules, each containing several eggs.

Fig. 282.

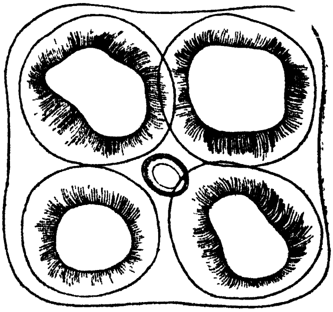
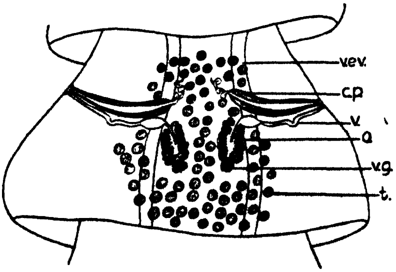


Fig. 283.



Cotugnia margareta.

Fig. 282.—Head, viewed *en face*, × 80. (Original.)
Fig. 283.—Mature segment, × 28. (Original.)

(4) Cotugnia margareta Beddard, 1916. (Figs. 282 & 283.)

Synonym :—*Cittotænia avicola* Southwell, 1922.

From (1) Crows (*Corvus macrorhynchus*); Zoological Gardens, Calcutta. Southwell. (2) A moonal pheasant (*Lophophorus refulgens*); Zoological Gardens, Calcutta. Southwell.

This species is differentiated from all others of the genus by the fact that the rostellum is smaller than the suckers. Beddard obtained it from a pheasant. In the specimens from the Indian crow the rostellum was also smaller than the suckers, and the worm could not be distinguished from *C. margareta* Beddard, 1916.

Fig. 284.

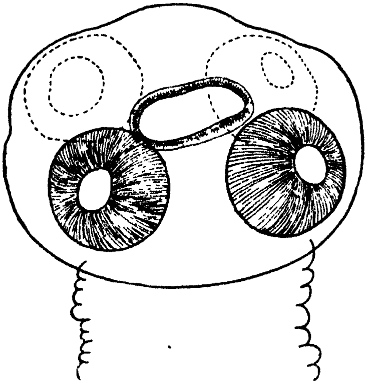
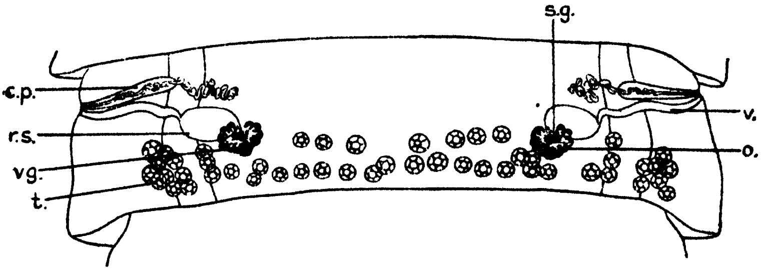


Fig. 285.



Cotugnia fastigata.

Fig. 284.—Head, × 80. (Original.)
Fig. 285.—Mature segment, × 47. (Original.)

(5) Cotugnia fastigata Meggitt, 1920. (Figs. 284 & 285.)

From (1) Domestic ducks; Rangoon. Meggitt. (2) A parrot (?*Ptistes coccineopterus*); Zoological Gardens, Calcutta. Southwell.

The worm measures 3 cm. in length and the maximum breadth is 6 mm. All the proglottides are broader than long. The strobila is triangular; the head measures from 500 to 600 μ in diameter and is provided with four unarmed suckers and an armed rostellum. The latter has a diameter of about

300 μ and bears approximately 200 hooks, each about 20 μ in length, and arranged in a double row.

The musculature consists of three longitudinal layers, each of which is bounded internally by a thin band of transverse muscles. The most internal longitudinal layer consists of large irregular bundles, and the outermost of fibres extending to the cuticle.

Dorsal longitudinal excretory vessels are absent in mature segments. The genital pores are situated laterally in the anterior quarter of the segment.

The testes are distributed as a narrow band consisting of two or three rows along the posterior margin of the proglottis. Laterally they surround the ventral excretory vessel, and extend as far as the nerve. The cirrus sac is long and narrow and reaches the nerve. Between the sac and the testes the vas deferens, which is surrounded by numerous gland-cells, is thrown into a closely packed coil.

The ovary is deeply lobulated. It is asymmetrical, and lies postero-ventrally to the receptaculum seminis, close to the excretory vessel. The vitelline gland is small, compact, and situated posteriorly and slightly aporally to the ovary; it is surrounded laterally by testes. The vagina is short, almost straight, and the receptaculum seminis is small and spindle-shaped. The uterus at first consists of a narrow branched tube situated anteriorly to the ovary, but it soon disappears, and the eggs come to lie singly in parenchymatous capsules.

Meggitt recorded this species from ducks; the writer obtained it from a parrot. In the latter case the worms agreed in detail with Meggitt's description of this species, and the writer has no option but to consider them identical, even though the hosts are so widely different.

(6) **Cotugnia cuneata** var. **tenuis** Meggitt, 1924.

From pigeons (*Columba* sp.).; Rangoon. Meggitt.

The worm measures 3 cm. length and the maximum breadth is 1 mm. The scolex has a diameter of 260 μ and the rostellum is armed with a double circle of about 200 hooks, 14 and 18 μ in length, the long and short ones alternating. Behind the rostellum there is a circular cushion; the suckers are unarmed. Posteriorly the proglottides are longer than broad. The genital pores are situated near the middle of the margin of the proglottis.

The musculature is weakly developed and consists of two layers of longitudinal muscles each between two transverse ones. The inner longitudinal layer consists of about 15 dorsal and 15 ventral bundles.

The testes are situated in the posterior half of the segment, and a few occasionally extend laterally to the longitudinal excretory vessels. The cirrus sac is large, often extending internally to the longitudinal excretory vessel; the vas deferens forms a number of coils immediately median to the cirrus sac.

The two lobed ovaries lie posteriorly to the cirrus sacs close to the longitudinal excretory vessel and often close together. Each ovary presents a deep concavity directed posteriorly. The vagina is a short curved duct situated, like all the genital organs, posteriorly to the cirrus. The eggs occur singly in thick-walled capsules which extend laterally to the excretory vessels.

(7) **Cotugnia cuneata** var. **nervosa** Meggitt, 1924.

From (1) Pigeons (*Columba* sp.); Rangoon. Meggitt. Kasauli, India. Joyeux and Houdemer. (2) Red turtle-doves; Nagpur, Central Provinces, India. Moghe.

This variety resembles var. *tenuis* closely; it differs in being much larger, in the segments being broader than long, and in the musculature being strongly developed.

The worm measures up to 6 cm. in length and 3 mm. in breadth. It appears doubtful whether these two so-called varieties can be differentiated either from each other or from *C. cuneata*.

(8) **Cotugnia seni** Meggitt, 1926.

From *Platycercus eximius*; Victoria Memorial Park, Rangoon. Meggitt.

The worm measures 10 mm. in length and has a maximum breadth of 1 mm. The specimens hitherto obtained have been mature but not gravid. All the proglottides are broader than long. The genital pores are situated in the anterior margin of the proglottis at the bottom of a shallow genital atrium. The scolex measures from 350 to 360 μ in diameter and the rostellum from 210 to 270 μ; the latter is armed with a single row of about 200 hooks, each of which measures from 10·5 to 12·5 μ in length; the suckers are unarmed.

The testes vary in number from 30 to 40, forming a single broad transverse band rarely extending laterally to the excretory vessels, and situated behind the female glands. The cirrus sac is slender, measuring 190 μ in length and extending just median to the excretory vessels; the coils of the vas deferens are few in number.

The ovary and vitelline gland are prominently lobed; the receptaculum seminis is large and spherical.

Subfamily II. OPHRYOCOTYLINÆ, Fuhrmann, 1907.

Rostellum very large and armed with two rows of hooks. Uterus persistent. Adults in birds.

Type-genus :—*Ophryocotyle* Friis, 1870.

Genus **OPHRYOCOTYLE** Friis, 1870.

Rostellum armed with hooks arranged in two rows of wavy lines. Suckers armed anteriorly only with four rows of hooks. Genital pores alternate.

Type-species :—*Ophryocotyle proteus* Friis, 1870.

Ophryocotyle zeylanica Linstow, 1906. (Fig. 286.)

From the Ceylonese hornbill (*Lophoceros gingalensis*); Nedunkeni, Northern Provinces, Ceylon. ? Willey.

The worm attains a length of about 5·5 cm. and a maximum breadth of 700 μ. The posterior segments are longer than broad. According to Clausen (1915) the genital pores are usually regularly alternate. The scolex is almost square, having a breadth of 250 μ. The neck measures 1 mm. in length. The rostellum is well developed and somewhat button-shaped; it bears a large number of hooks arranged in a double row, each row being markedly undulated. The hooks measure 10 μ in length and resemble those of the genus *Raillietina*. The suckers are armed anteriorly with minute hooks. On each side the ventral excretory vessel is larger than the dorsal. The longitudinal muscles are disposed in two layers of bundles, the inner one being much more strongly developed than the outer.

There are about 18 testes, situated at the extreme posterior margin of the segment. The cirrus sac is strongly developed, measuring 140 by 47 μ and extending beyond the ventral excretory vessel. Both genital ducts pass between the excretory vessels and dorsally to the nerve; the vagina lies ventrally to the cirrus sac. An internal seminal vesicle is present.

The ovary is very strongly developed, lobed, and situated in front of the testes; behind it, and ventrally, lies the vitelline gland; the shell gland is small, measuring 25 μ. The vagina opens, with the vas deferens, into a genital atrium, its terminal part being dilated and surrounded with cells. Near the poral excretory vessel, and median to it, this organ expands into a conspicuous receptaculum seminis. The uterus is very voluminous and fills the entire internal parenchyma. It is divided up by partitions, and persists in the ripe segments in the form of a lobed sac; in this respect it differs from species of *Raillietina* because in the latter genus the uterus is replaced by capsules. Mature eggs unknown.

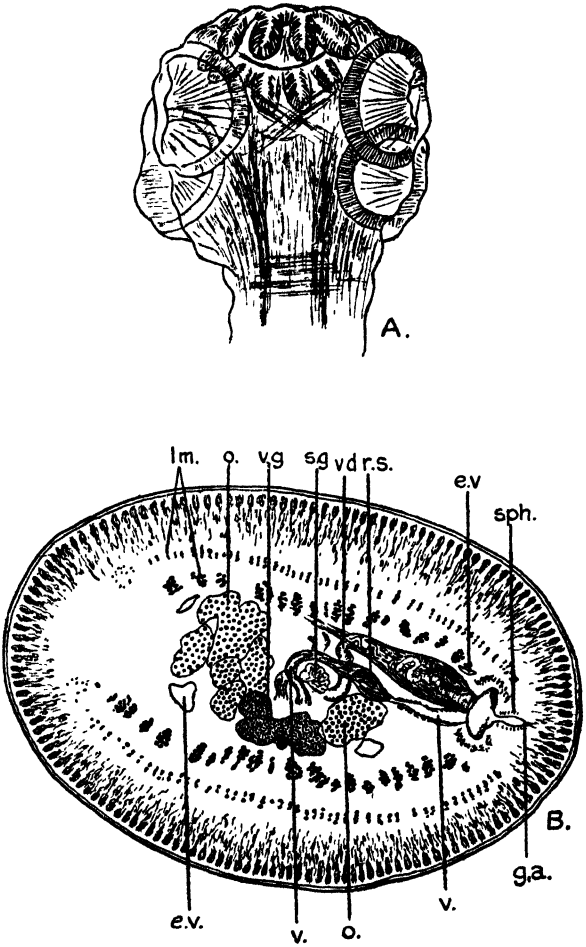


Fig. 286.—*Ophryocotyle zeylanica.* A, head; B, transverse section of mature segment, magnification unknown. (After Clausen.)

Family IV. HYMENOLEPIDIDÆ Railliet & Henry, 1909.

Fuhrmann (1907) placed in this family, which he called Hymenolepinidæ, the genera *Oligorchis*, *Diorchis*, *Aploparaksis*, and *Hymenolepis* (with the subgenus *Echinocotyle*). At the same time he erected another family, viz., Dilepinidae, with the three subfamilies Dilepininæ Fuhrmann, 1907; Dipylidiinæ Railliet, 1896; and Paruterinæ Fuhrmann, 1907. In 1926 he retained his earlier classification in its broad outlines, but he united the family Fimbriariidæ Wolff, 1898 (containing the single genus *Fimbriaria* Frohlich, 1802) with the family Hymenolepididæ Railliet & Henry, 1909. He also removed the genus *Diploposthe* Jacobi, 1896, from the family Acoleidæ Ransom, 1909, and placed it in the Hymenolepididæ Railliet & Henry, 1909, on the ground that the species of this genus (viz., *D. lævis* Bloch, 1782) usually, but not invariably, has three testes in each segment. Ransom placed the genus *Diploposthe* Jacobi, 1896, in the family Tæniidæ Ludwig, 1886. Following Meggitt (1924) and Mayhew (1925), the genus *Diploposthe* is here placed in the family Acoleidæ Ransom, 1909.

Ransom (1909) united the two families Dilepinidæ Fuhrmann, 1907, and Hymenolepididæ Railliet & Henry, 1909. into one family, viz., Hymenolepididæ Railliet & Henry, 1909. He also united, under the name Dipylidiinæ Stiles, 1896, the two subfamilies Dilepininæ Fuhrmann, 1907, and Dipylidiinæ Stiles, 1896. Therefore, in Ransom's classification the family Hymenolepididæ Railliet & Henry, 1909, contains two subfamilies, viz., Dipylidiinæ Stiles, 1896, and Paruterininæ Ransom, 1909.

Meggitt (1924) divided the family Hymenolepididæ Railliet & Henry, 1909, into five subfamilies, viz. Hymenolepidinæ Ransom, 1909; Dipyliinæ (*sic*) Stiles, 1896; Dilepininæ Fuhrmann, 1907; Paruterininæ Ransom, 1909; and Fimbriariinæ Meggitt, 1924.

Mayhew (1925) accepts Fuhrmann's restriction of the family Hymenolepididæ (Ariola, 1899), and he divides the family up as follows:—

Subfamily 1. Hymenolepididæ (Perrier, 1897) Ransom 1909 (emended) (apparently a misprint for Hymenolepinæ Perrier, 1896). With three testes in each proglottis. Type genus:—*Hymenolepis* Weinl., 1858.

The old genus *Hymenolepis* he divided into three genera, viz.:—(1) *Hymenolepis* Weinland, 1858, with three testes in a transverse row. Type-species:—*Hymenolepis diminuta*

(Rudolphi, 1819). (2) *Weinlandia* Mayhew, 1925, in which one testis is poral and two aporal; of the latter, one is anterior to the other. Type-species :—*Weinlandia macrostrobilodes* Mayhew, 1925. (3) *Wardium* Mayhew, 1925, in which the testes are variable in position. Type-species :—*Wardium fryei* Mayhew, 1925. He also includes the genera *Fimbriaria* Frohlich, 1802, *Echinorhynchotœnia* Fuhrmann, 1909, and *Hymenofimbria* Skrjabin, 1914, in this subfamily.

Subfamily 2. Oligorchinæ. With four testes in each proglottis. Type and only genus :—*Oligorchis* Fuhrmann, 1906.

Subfamily 3. Diorchinæ. With two testes in each proglottis. Type and only genus :—*Diorchis* Clerc, 1903.

Subfamily 4. Haploparaxinæ. With regularly a single testis in each proglottis. Type and only genus :—*Haploparaxis* Clerc, 1903=*Aploparaksis* Clerc, 1903.

Meggitt (1927) notes that Mayhew has erected three subfamilies for three genera ; he does not accept this classification, and at the same time he points out that the division of the old genus *Hymenolepis* into the three genera, *Hymenolepis*, *Weinlandia*, and *Wardium*, according to the position of the testes, is unsatisfactory. He calls attention to the four following facts : (1) that the type-species of the genus *Hymenolepis* is *H. diminuta* (Rud., 1819) ; (2) that in this species the testes are inconstant in position ; (3) that constancy in the arrangement of the testes may not exist within the subfamily ; and (4) that, in any case, in actual practice the system is unworkable. He accordingly does not accept Mayhew's genera *Wardium* and *Weinlandia*.

In the genus *Hymenolepis* the rostellum is usually armed with a single crown of hooks, more rarely it is unarmed. The writer (1921) described under the name *Dilepis kempi* a worm in which the rostellum bears 20 hooks in two rows, and in which the mature segments have three testes. Mayhew placed the worm in the genus *Hymenolepis* because the species possesses three testes, even though the head bears a *double* row of hooks.

Fuhrmann's classification of the family is adopted below :—

Hymenolepididæ Railliet & Henry, 1909. Scolex usually furnished with a rostellum armed with a single row of hooks, rarely with a double row, or unarmed. Segments always broader than long ; genital pores unilateral, rarely double. Genital ducts pass dorsally to the excretory vessels and nerve. Testes few, from one to four. The vas deferens is always dilated into an internal and an external seminal vesicle. Uterus sac-shaped, rarely reticular. Eggs with three envelopes.

Type-genus :—*Hymenolepis* Weinland, 1858.

The family is represented in India by the genera *Hymenolepis* Weinland, 1858 (with the subgenus *Echinocotyle* Blanchard, 1891), and *Fimbriaria* Frohlich, 1802. The writer does not accept Mayhew's genera *Wardium* and *Weinlandia*.

Key to Genera.

Strobila not segmented externally, but with transverse grooves; pseudoscolex present.	FIMBRIARIA, p. 151.
Strobila definitely segmented; pseudoscolex absent	HYMENOLEPIS, p. 118.

Genus I. **HYMENOLEPIS** Weinland, 1858.

Synonyms:—*Diplacanthus* Weinland, 1858.
Lepidotrias Weinland, 1858.
Drepanidotænia Railliet, 1892.
Dicranotænia Railliet, 1892.
Triorchis Clerc, 1903.

Rostellum generally well developed and armed with a single crown of hooks (a double crown in *H. kempi* (Southwell, 1921) and *H. ficticia* Meggitt, 1927), sometimes rudimentary and unarmed. Suckers in adult generally unarmed, rarely armed with hooklets or fine spines. Testes three in each segment. Vas deferens with internal (*i. e.*, inside the cirrus sac) as well as external seminal vesicle (outside the cirrus sac). Sacculus accessorius generally absent. Adults in mammals and birds.

Type-species:—*Hymenolepis diminuta* (Rud., 1919) Blanchard, 1891.

Key to Species.

1.	Scolex unarmed	2.
	Scolex armed	3.
2.	Testes median to excretory vessels.	
	a. Parasites of rats	*H. diminuta*, p. 119.
	b. Parasites of fowl	*H. rustica*, p. 141.
	Testes external to excretory vessels	*H. phalacrocorax*, p. 143.
3.	Hooks in two rows	4.
	Hooks in a single row	5.
4.	20 hooks 135 and 175 μ	*H. kempi*, p. 127.
	24 hooks 45 and 50 μ	*H. ficticia*, p. 141.
5.	Rostellum armed with 8 hooks	6.
	Rostellum armed with 10 hooks	7.
	Rostellum armed with 12 or more hooks.	8.
6.	Rostellar hooks 110 to 130 μ	*H. liguloides*, p. 132.
	Rostellar hooks 90 μ	*H. megalorchis*, p. 136.
	Rostellar hooks 88 to 95 μ	*H. rugosa*, p. 126.
	Rostellar hooks 76 to 82 μ	*H. gracilis*, p. 130.
	Rostellar hooks 72 μ, peculiarly shaped; in pigeons	*H. sphenocephala*, p. 131.
	Rostellar hooks 57 μ	*H. clausa*, p. 126.
	Rostellar hooks 30 to 35 μ	*H. lanceolata*, p. 121.
7.	Rostellar hooks 30 to 36 μ; eggs 60 μ	*H. zosteropis*, p. 137.
	Rostellar hooks 32 μ; eggs 17 μ	*H. annandalei*, p. 139.
	Rostellar hooks 28 μ	*H. spinosa*, p. 124.

Rostellar hooks 18 to 23 µ	*H. farciminosa*, p. 129.
Rostellar hooks 16 µ	*H. fusa*, p. 124.
8. With 12 rostellar hooks 16 to 18 µ	*H. minutissima*, p. 142.
With 16 rostellar hooks 16 µ	*H. solitaria*, p. 142.
With 20 hooks 12 to 17 µ—	
a. Worms 3 cm. in length	*H. simplex*, p. 137.
b Worms 12 to 19 cm. in length	*H. coronula*, p. 132.
With 22 hooks 30 to 34 µ	*H. medici*, p. 135.
With 25 hooks 19 to 24 µ	*H. furcata*, p. 134.
With 24 to 28 hooks 14 to 18 µ	*H. murina*, p. 122.

Not included in Key.

Hooks unknown	*H. septaria*, p. 125.
Hooks 20 to 24 µ, number unknown	*H. clerci*, p. 144.

In the differentiation of the species possessing hooks of approximately the same size it is necessary to note that their shape is of great diagnostic value.

(1) **Hymenolepis diminuta** (Rudolphi, 1819). (Figs. 287 & 288.)

Synonyms:—*Tænia leptocephala* Lussana & Romaro, no date.
Tænia diminuta Rudolphi, 1819.
Tænia leptocephala Creplin, 1825.
Tænia flavopunctata Weinland, 1858.
Lepidotrias flavopunctata Weinland, 1858.
Hymenolepis flavopunctata Weinland, 1858.
Tænia flavomaculata Leuckart, 1863.
Tænia varesina Parona, 1884.
Tænia minima Grassi, 1886.
Tænia relicta Zschokke, 1887.
?*Hymenolepis relicta* Zschokke, 1887.
Cysticercus hymenolepis-diminutæ Railliet, 1892.
Cysticercus tæniæ-diminutæ (Rudolphi, 1819) Dolley, 1894.
Tænia megaloon Linstow, 1901.
Hymenolepis crassa Janicki, 1904.
Hymenolepis sp., Janicki, 1904.
Hymenolepis diminutoides Cholodkovsky, 1912.

From rats; Rangoon. Meggitt.

The worm attains a length of from 20 to 60 cm. and a breadth of from 2·5 to 4 mm. It is composed of from 600 to 1000 segments, all of which are broader than long. The genital pores are situated at the anterior third of the lateral margin of the segment. The scolex varies in diameter from 250 to 500 µ; a rostellum is present, but it is unarmed. The three testes are normally in the same straight line, the single poral testis being separated from the two aporal ones by the ovary, but they are extremely variable in arrangement. The egg measures from 54 to 86 µ in diameter. The larval stages occur in the meal-moth (*Asopia farinalis*), an earwig (*Anisolabis annulipes*), beetles such as *Akis spinosa*, *Scaurus striatus*, and the meal-worm beetle (*Tenebrio molitor*), rat-fleas (*Ceratophyllus fasciatus*, *Xenopsylla cheopis*), a species of myriopods, and in Japan in various insects such as the tabby-moth

(*Aglossa dimidiata*), beetle (*Tribolium ferrugineum*), pyralid moth (*Paralipsa gularis*), and flour-moth (*Tinea granella*),.

Fig. 287.

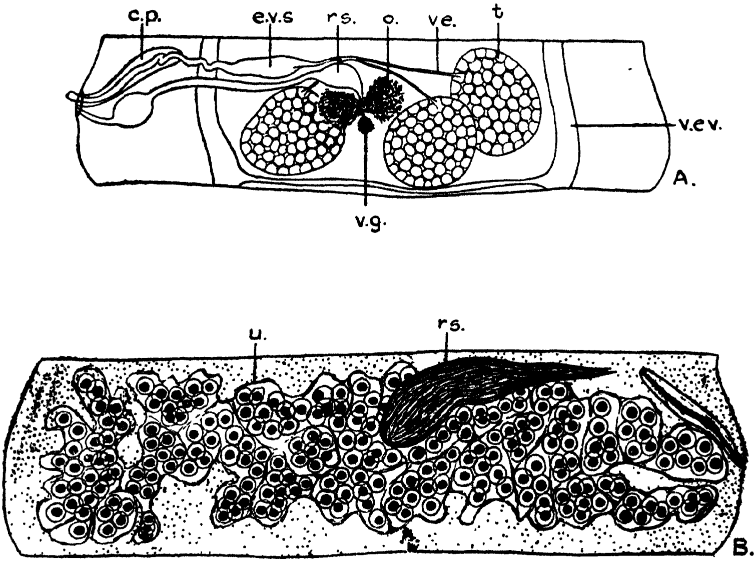
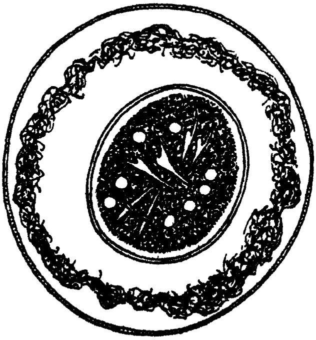


Fig. 288.



Hymenolepis diminuta.

Fig. 287.—A, mature segment, × 84; B, gravid segment, × 53. (Original)
Fig. 288.—Egg, × 770. (Original.)

Meggitt (Burma) records *H. sciurina* Cholodkovsky, 1912, from *Sciurus erythræus* Pallas, 1788; probably his species was *H. diminuta* Rudolphi, 1819. Meggitt's worms had a length of 50 mm. and a breadth of 2 mm. The scolex had a diameter of 250 μ, and rostellar hooks were absent. The three testes were all in the same straight line; the cirrus sac measured 270 to 300 μ by 250 μ in gravid segments, and it extended almost to the excretory vessels. The ovary was situated between the most poral testis and the next. In the apparent absence of hooks Meggitt was uncertain whether this worm was Cholodkovsky's species (obtained from *Sciurus vulgaris*) or whether it was a specimen of *H. diminuta* (Rud., 1819).

Cholodkovsky's species attains a length of from 5 to 10 cm. and a maximum breadth of 1·5 mm. The three testes in his specimens were situated, not in a straight line, but one porally and two aporally. The uterus was a complicated sac, and the egg measured about 40 by 20 μ. No mention is made by Cholodkovsky of hooks on the head, but the position of the testes in Meggitt's specimens indicates that probably his species is not identical with *H. sciurina*. As a result we must accept Meggitt's suggestion that his worm was probably *H. diminuta* (Rudolphi, 1819).

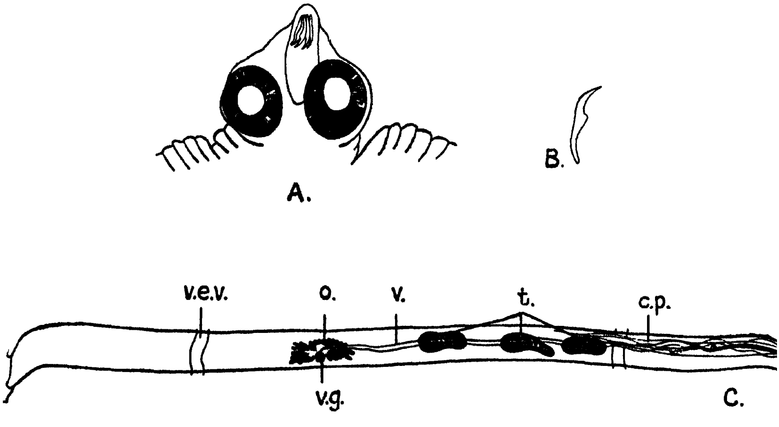


Fig. 289.—*Hymenolepis lanceolata.* A, head, × 150; B, rostellar hook, × 334; C, mature segment, × 20. (Original.)

(2) **Hymenolepis lanceolata** (Bloch, 1782) Weinland, 1858. (Fig. 289.)

Synonyms :— *Tænia lanceolata* Bloch, 1782.
Drepanidotænia lanceolata (Bloch, 1782) Railliet, 1893.

From the black Australian swan (*Chenopis atrata*); Berhampur, Bengal. Southwell.

This species is extremely variable. The largest specimens attain a length of about 13 cm. and a maximum breadth of

1·8 cm. Fully gravid segments are frequently found in the small specimens, which are only 1·1 cm. in length and 300 μ in breadth. In some worms either the male or female organs may be completely absent, and other abnormalities occur. All the segments are broader than long, and the unilateral genital pores are situated near the anterior corner of the lateral margin of the segment. The head is extremely small and globular; it bears a rather long cylindrical rostellum slightly swollen at its apex, and is armed with a single row of 8 hooks, each having a length of from 30 to 35 μ.

The three testes are in line, in the posterior part of the segment and on the pore side of the ovary. The cirrus sac is very small and the cirrus is armed.

The ovary is situated on the aporal third of the segment. The egg is oval and measures about 50 by 35 μ.

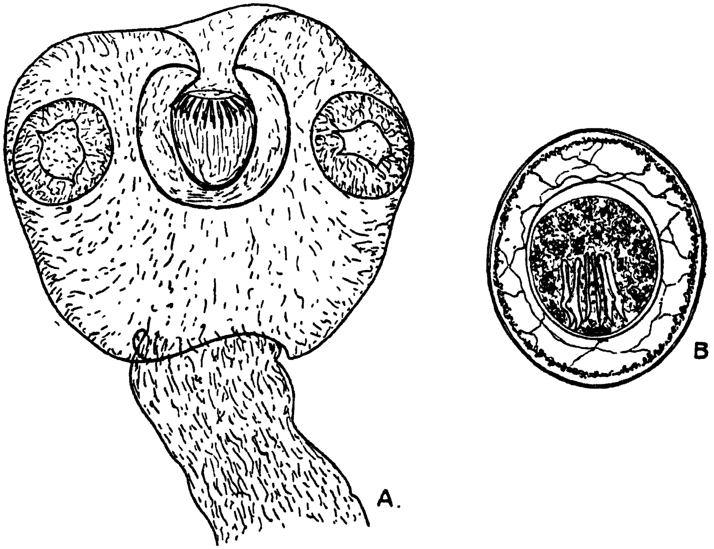


Fig. 290.—*Hymenolepis murina.* A, head, × 212; B, egg, × 760. (Original.)

(3) Hymenolepis murina (Dujardin, 1845) R. Blanchard, 1891. (Fig. 290.)

Synonyms:—*Tænia murina* Dujardin, 1845.
Tænia nana Siebold, 1852.
Diplacanthus nanus (Siebold, 1852) Weinland, 1858.
Lepidotrias murina (Dujardin, 1845) Weinland, 1858.
Tænia ægyptica Bilharz, 1852.
Hymenolepis nana (Siebold, 1852) R. Blanchard, 1891.
Hymenolepis nana var. *fraterna* Stiles, 1906.
Hymenolepis inexpectata Cholodkovsky, 1912.
Hymenolepis longior Baylis, 1922.

From rats; Lahore. Southwell. Rangoon. Meggitt. A frequent parasite of man throughout India.

It will be noted that the species *H. murina* found in the rat is here considered identical with the species *H. nana* found in man. Apparently the name *murina* has priority.

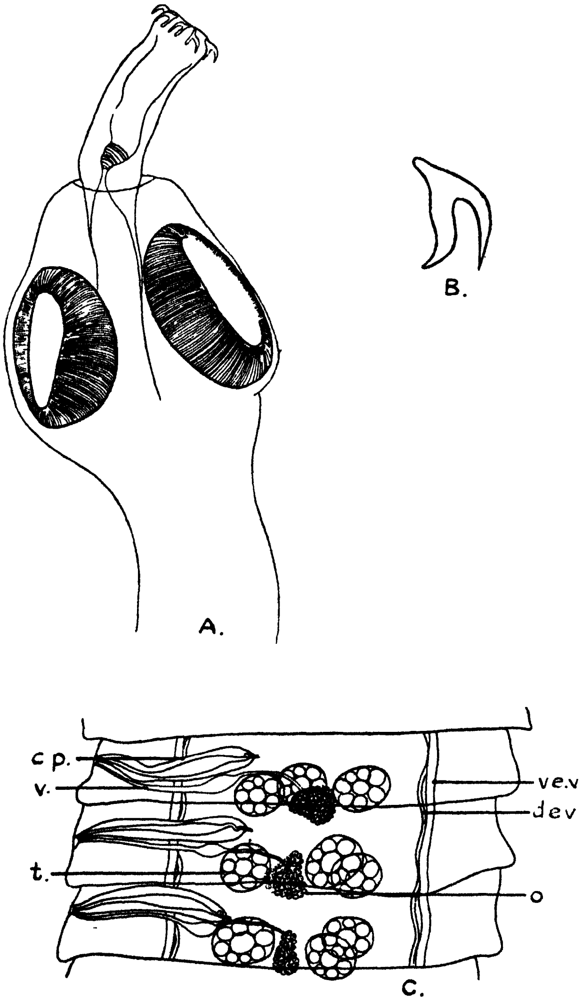


Fig. 291.—*Hymenolepis fusa.* A, head, × 225; B, rostellar hook, × 1000; C, mature segments, showing irregular disposition of testes, × 100. (Original.)

The worm attains a length of from 7 mm. to 8 cm. (sometimes even 14 cm.) and a breadth of from 500 to 900 μ. It is composed of about 200 segments. The scolex is almost globular, and measures from 210 to 480 μ in length. The rostellum bears a single crown of from 24 to 28 hooks, each measuring 14 to 18 μ in length. The neck is moderately long; the genital pores are situated in the anterior half of the lateral margin of the segment. The three testes are in the same straight line, but are subject to considerable variation in position. The cirrus sac is small and does not extend to the excretory vessels. The egg measures from 30 to 60 μ in diameter and the oncosphere from 16 to 19 μ. The adult occurs in rodents and man, and the life-history is direct, *i. e.*, when the eggs are swallowed by the final host, cysticercoids develop in the intestinal villi and later on drop into the lumen of the gut, to which they attach themselves.

(4) **Hymenolepis fusa** (Krabbe, 1869), Fuhrmann 1906. (Fig. 291.)

Synonym:—*Tænia fusa* Krabbe, 1869.

From *Larus brunneicephalus*; Zoological Gardens, Calcutta. Southwell.

The worm attains a length of about 9 cm. and a maximum breadth of 1 mm. All the segments are extremely short and their lateral margins are strongly salient. The genital pores are situated at the extreme anterior corner of the segment. The head is globular, having a diameter of 210 μ. The rostellum has a length of 105 μ and a breadth of 34 μ; it is armed with 10 hooks, each 16 μ in length and of the shape figured by Krabbe for this species.

The three testes are disposed irregularly; thus in some segments there are two aporal testes, in other segments two poral testes, whilst in still others one testis lies between, and anterior to, the other two. The cirrus sac is a conspicuous structure extending in a straight line almost to the middle of the segment. The uterus is a simple sac full of eggs.

(5) **Hymenolepis spinosa** Linstow, 1906. (Fig. 292.)

From the painted snipe (*Rostratula capensis*); Vavuniya, Ceylon. ? Willey.

The worm attains a length of about 1·5 cm. and a maximum breadth of 620 μ. All the segments are broader than long. The genital pores are unilateral and are situated at the junction of the first and second quarters of the lateral margin of the segment. The rostellum is armed with ten hooks, each measuring 28 μ. The cortex is well developed, limited internally by a layer of transverse muscles; there are numerous small groups of longitudinal muscle bundles and, in addition, eight strong bundles of longitudinal fibres. The ventral excretory vessel is much larger than the dorsal. Of the three large testes, one is anterior, close to the cirrus sac, and the other two side by side further back. The cirrus is large and occupies almost one-third of the transverse diameter.

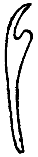


Fig. 292.—*Hymenolepis spinosa.* Rostellar hook, magnification unknown. (After Linstow.)

The ovary is median, and behind it lies the vitelline gland, which occupies a quarter of the transverse diameter of the segment. The shell gland is ovate and is situated centrally between the second and third testes. The coiled vagina is situated a little on the poral side of the middle line. The genital ducts pass between the excretory ducts. The egg measures about 47 μ and the oncosphere 26 by 18 μ.

(6) **Hymenolepis septaria** Linstow, 1906.

From *Upupa ceylonensis*; Weligatta, Ceylon. ? Willey.

The worm attains a length of 2·5 cm. and a maximum breadth of 790 μ. The last segments are longer than broad. The scolex is truncated anteriorly and measures 130 μ in length and 220 μ in breadth. The rostellum is small and knob-shaped; hooks absent, probably lost. There is no neck. The dorsal excretory vessel on each side is larger than the ventral. The longitudinal muscles are in circular bundles just beneath the thick cuticle; calcareous corpuscles absent.

The three testes are oval, all in a row, and situated dorsally in the middle of the segment. The cirrus sac has its internal extremity directed obliquely ventrally. The ovary is strongly developed and occupies the whole length of the segment; it gives off ventrally a broad transverse branch from which, to the right and left, two broad cornua extend in the form of a horse-shoe towards the dorsal side, leaving room for the testes, the vitelline gland, and the shell gland. The vitelline gland is in the middle line, ventral to the testes, and the shell gland is still more ventral in position. The uterus completely fills the gravid segments, and is subdivided by dorso-ventral septa. The egg measures 73 by 64 μ.

(7) **Hymenolepis clausa** Linstow, 1906. (Fig. 293.)

From the whistling teal (*Dendrocygna javanica*); Tissamaharama, Ceylon. ? Willey.

The worm measures 1·8 cm. in length and has a maximum breadth of 1·5 mm. There is no neck. According to Linstow, genital pores are absent and the dorsal cirrus sac and the ventral vagina merge into one another, directly a little distance from the posterior margin of the segment. The scolex measures about 100 μ in length by 230 μ in breadth. The rostellum is globular and is armed with 8 hooks, each measuring 57 μ in length.

The longitudinal muscles are in two layers of bundles, the outer ones small and numerous, and the inner large and few.

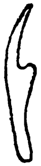


Fig. 293.—*Hymenolepis clausa.* Rostellar hook, magnification unknown. (After Linstow.)

The three testes are dorsal and posterior, the central one being a little behind the other two. The cirrus sac is very large, extending three-fifths the distance across the segment. The cirrus is long and coiled. The orifice of the cirrus sac, where it passes into the vagina, is closely beset with small spinules. The racemose ovary is asymmetrical, ventral to the vagina, and transversely elongated; immediately in front of it is the rounded shell gland; eggs unknown.

(8) **Hymenolepis rugosa** Clerc, 1906, var. **birmanica** Meggitt, 1924. (Fig. 294.)

From pigeons (*Columba* sp.); Rangoon. Meggitt.

The worm attains a length of 7 cm. and a breadth of 600 μ. The scolex has a diameter of 200 μ and bears four unarmed suckers. The rostellum is armed with 8 hooks, each measuring from 88 to 95 μ in length. These hooks differ from those of *H. rugosa* in size and in having the proximal end slightly bent. The hooks extend posterior to the suckers. The genital pores are situated in the extreme anterior angle of the margin of the proglottis. The genital atrium is very small.

Musculature. The longitudinal muscle-bundles are well developed; internal to them is a delicate layer of transverse muscles; internal to the circular muscles is a second layer of longitudinal muscles consisting of 8 muscle-strands, and arranged two between the excretory vessels and two internal to them on each surface of the worm. A second delicate sheet of transverse muscles separates the cortex from the medulla.

Male Genitalia. The testes are dorsal, and they usually lie in a straight line, but of the two aporal testes one may be anterior or ventral to the other. The cirrus sac extends beyond the aporal excretory vessels, and in some cases almost to the aporal margin of the proglottis. The cirrus is armed. The internal vesicula seminalis occupies about half the cirrus sac whilst the external vesicula seminalis extends from the aporal excretory vessel a third the length of the cirrus.

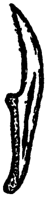


Fig. 294.—*Hymenolepis rugosa* var. *birmanica*. Rostellar hook, × 267. (After Meggitt, in 'Parasitology.')

Female Genitalia. The ovary is somewhat lobed and, when fully developed, touches the excretory vessel on each side. The receptaculum seminis extends from the poral excretory vessel to the centre of the proglottis. Uterus not described.

(9) **Hymenolepis kempi** (Southwell, 1921) Mayhew, 1925. (Fig. 295.)

Synonym :—*Dilepis kempi* Southwell, 1921.

From the little cormorant (*Phalacrocorax niger*) ; North Loktak Lake, Manipur, Assam. 14.2.20. Station 1. Manipur Survey, Zoological Survey of India.

Southwell placed this species in the genus *Dilepis* on accouut of the fact that the head bears a double row of hooks. Mayhew referred it to the genus *Hymenolepis* because of the presence of three testes, even though in his description of the genus he states that the rostellum is "armed with a single crown of hooks or it may be unarmed." It is clear that the species cannot definitely be placed in Mayhew's genus *Hymenolepis* as defined by him. The characters of the worm are those of the genus *Dilepis*, except that there are three testes only.

The largest worm measures 5 cm. in length and the greatest breadth is about 1 mm. It contains over 500 segments, all of which are broader than long; the posterior segments measure about 400 μ in length and 900 μ in breadth. The genital pores are unilateral and are situated in the anterior half of the segment. The head is about 220 μ in length and 400 μ in breadth. The rostellum measures about 170 μ in length and 160 μ in breadth; it is armed with 20 hooks arranged in a double row. The hooks in the posterior row curve backwards strongly and measure about 135 μ, whilst those in the anterior row are not so strongly curved, and measure about 175 μ. The diameter of the suckers is about 100 μ. There is no neck.

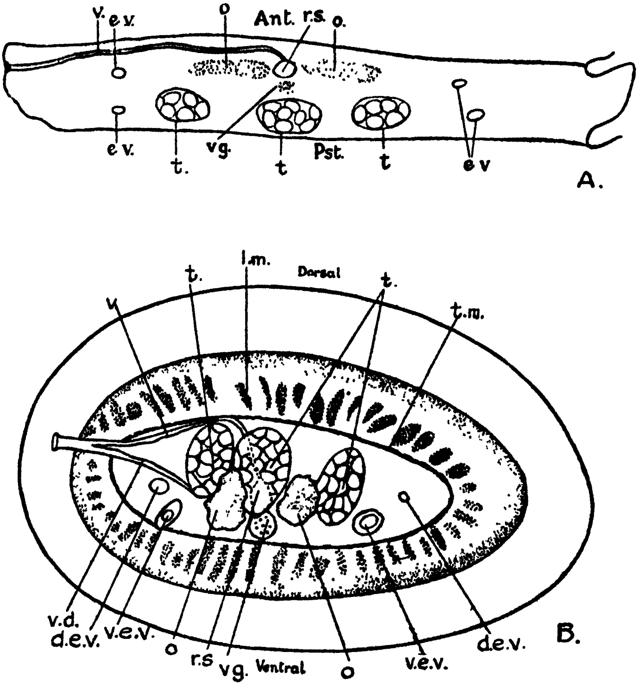


Fig. 295.—*Hymenolepis kempi.* A, horizontal section of mature segment, × 105; B, transverse section of mature segment, × 75. (After Southwell.)

Male Genitalia. There are three testes situated posteriorly, all in one line, two being aporal. They measure about 140 μ by 70 μ, their long diameter being dorso-ventral. The vas deferens arises somewhat ventrally and, curving dorsally to the vagina, runs to the pore. The cirrus sac is small and insignificant.

Female Genitalia. The ovary is situated in the median anterior field. It consists of two irregularly-shaped wings, each measuring about 160 μ in breadth. The vagina is conspicuous, running dorsally to the vas deferens and excretory vessel. It opens in front of the vas deferens; close to the ovary it dilates into a receptaculum seminis. The vitelline gland measures about 70 by 50 μ and lies posteriorly between the two wings of the ovary. The uterus is a large sac-like organ with very large and numerous diverticula, extending laterally to the excretory vessels on both sides; ripe eggs unknown.

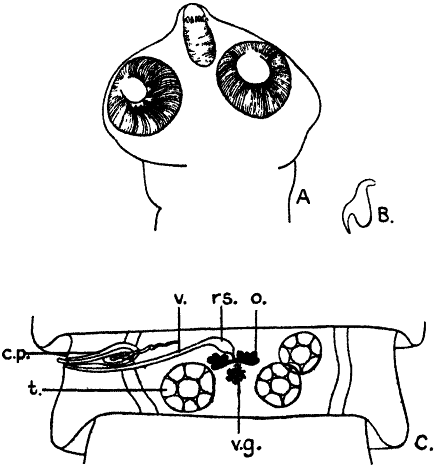


Fig. 296.—*Hymenolepis farciminosa.* A, head, × 90; B, rostellar hook, × 400; C, mature segment, × 53. (Original.)

(10) **Hymenolepis farciminosa** (Goeze, 1782). (Fig. 296.)

Synonyms:—*Tænia farciminosa* Goeze, 1782.
Tænia farciminialis Batsch, 1786.
Tænia acridotherides Parona, 1890.
Hymenolepis farciminalis (Batsch, 1786) R. Blanchard, 1891.
Diplacanthus farciminalis (Batsch, 1786) Volz, 1899.
Weinlandia farciminosa (Goeze, 1782) Mayhew, 1925.
Hymenolepis dahurica of Southwell, 1922.

From (1) *Corvus macrorhynchus*; Zoological Gardens, Calcutta. Southwell. (2) *Acridotheres tristis* and (3) *A. albocinctus*; Rangoon. Meggitt.

The worm attains a length of 72 cm. and a breadth of 1 mm. The genital pores are situated in the centre of the margin of the proglottis in old segments, but in young segments they are slightly anterior to the middle. The scolex has a diameter of

265 μ. The rostellum has a diameter of 100 μ and extends as far as the posterior margins of the suckers; it is armed with 10 hooks which, according to Krabbe, measure 23 μ, but Meggitt states that they are from 18 to 21 μ.

Male Genitalia. Of the two aporal testes, one is usually anterior and a little external to the other. The cirrus sac varies greatly in size in different parts of the strobila. Volz gives the length as 120 μ, and Meggitt states that it measures from 180 to 300 μ; it reaches slightly median to the excretory vessels. The external vesicula seminalis does not extend beyond the centre of the proglottis.

Female Genitalia. The ovary is especially deeply bilobed, each part being almost spherical, and attached only by a narrow isthmus. The uterus is partly septate.

(11) **Hymenolepis gracilis** (Zeder, 1803) Cohn, 1901. (Fig. 297.)

Synonyms:—*Tænia gracilis* Zeder, 1803.
Drepanidotænia gracilis (Zeder, 1803) Railliet, 1893.
Weinlandia gracilis (Zeder, 1803) Mayhew, 1925.

From (1) *Crocopus phœnicopterus*; Chilka Lake, Orissa, India. Southwell. (2) The tufted duck (*Nyroca fuligula*); Loktak Lake, Manipur, Assam. Southwell. (3) *Phœnicopterus roseus*; Zoological Gardens, Calcutta. Southwell. (4) Domestic ducks; Rangoon. Meggitt.

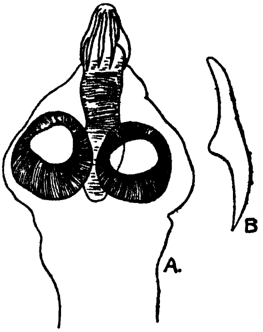


Fig. 297.—*Hymenolepis gracilis.* A, head, × 90; B, rostellar hook, × 240. (Original.)

The worm measures from 12 to 27 cm. in length and has a maximum breadth of about 2 mm. The rostellum has a length of about 100 μ and a breadth of 40 μ. It is armed with 8 rather simple hooks, each having a length of from 76 to 82 μ. The segments are, as is usual in this genus, broader than long; the posterior ones may be square. The genital pores are situated in the anterior quarter of the margin of the proglottis, and are frequently hidden by the overlap of the preceding segment. The longitudinal muscles are in 8 bundles.

Of the three testes, two are aporal, and of these two one is invariably external and anterior to the other. The cirrus sac extends nearly to the aporal longitudinal excretory vessel; there is a large and conspicuous external vesicula seminalis. The sacculus is also prominent.

The ovary is somewhat bilobed and is situated close to the poral and the internal aporal testes. The vitelline gland lies posteriorly between the two wings of the ovary. The vagina is prominent and sinuous, with a conspicuous receptaculum seminis.

Larval forms of this worm have been recorded in Europe from various Ostracods, such as *Cypris compressa*, *C. cinerea*, *C. ophthalmica*, *Cyclops viridis*, *Candona rostrata*, and *Diaptomus* sp.

(12) **Hymenolepis sphenocephala** (Rudolphi, 1809) Fuhrmann, 1906.

Synonyms:—*Hymenolepis columbæ* (Zeder, 1820).
Weinlandia sphenocephala (Rudolphi, 1809) Mayhew, 1925.

From pigeons (*Columba* sp.); Rangoon. Meggitt.

The worm measures about 6 cm. in length and has a maximum breadth of about 2 mm. The genital pores are situated in the anterior corner of the segment. The head is armed with 8 hooks of a peculiar shape, which measure 72 μ in length. There is a well-developed neck.

The musculature consists of an inner transverse layer, and of an outer longitudinal layer of four bundles.

Of the three testes two are aporal, one being anterior and external to the posterior testis. The cirrus sac is very long, extending three-quarters the distance across the proglottis; its internal extremity lies close to the anterior margin of the proglottis. There is a very prominent sacculus accessorius. The cirrus is frequently found evaginated; the free part sometimes measures up to 200 μ, its terminal portion is chitinized.

The vagina consists of two parts, first a muscular with a very wide lumen, which runs dorsally from the genital cloaca as far as the inner limit of the sacculus accessorius, where it opens into the second section, which is a very muscular duct with no apparent lumen. This is spirally coiled, and, running ventrally and anteriorly, it opens into an enormous receptaculum seminis. The egg has a diameter of about 36 μ and the oncosphere measures 24 μ.

(13) **Hymenolepis coronula** (Dujardin, 1845) Cohn, 1901.

Synonyms:—*Tænia coronula* Dujardin, 1845.
Dicranotænia coronula (Dujardin, 1845) Railliet, 1892.
Hymenolepis megalhystera Linstow, 1905.
Weinlandia coronula (Dujardin, 1845) Mayhew, 1925.

From domestic ducks; Rangoon. Meggitt.

The worm measures from 12 to 19 cm. in length and has a maximum breadth of 3 mm. The scolex measures about 2 mm. in length. The rostellum has a length of about 60 μ and is armed with about 20 peculiar hooks, each having a length of from 12·8 to 17·6 μ. The segments are very short. Of the three testes one is poral and two aporal. The position of the latter varies according to the state of contraction of the segment; when this is strongly contracted, the three testes are in the same straight line, but in a relaxed condition one aporal testis is anterior and internal to the others. The cirrus sac extends to the ventral longitudinal excretory vessel; the internal vesicula seminalis occupies two-thirds of the sac. The sacculus accessorius is small, uniform in diameter, and straight. The external vesicula seminalis is a small spindle-shaped dilatation situated dorsally and laterally to the receptaculum seminis.

The ovary is a rather elongated organ placed posteriorly and occupying one-third the breadth of the proglottis. The vitelline gland lies posteriorly and ventrally to the ovary. The receptaculum seminis is very large, extending from the ventral longitudinal excretory vessel halfway across the proglottis. The uterus at first is a narrow sac twisted upon itself, as a result of which its cavity appears to be divided up into a series of separate compartments. When fully developed it occupies all the proglottis, extending beyond the excretory vessels. Mature eggs have apparently not been found. Larval forms of this species have been recorded in Europe from several species of Ostracods, viz., *Cypris compressa*, *C. ovum*, *C. ophthalmica*, *C. cinerea*, and *Candana candida*.

(14) **Hymenolepis liguloides** (Gervais, 1847). (Fig. 298.)

Synonyms:—*Halysis liguloides* Gervais, 1847.
Tænia liguloides (Gervais, 1847) Diesing, 1850.
Tænia caroli Parona, 1887.
Drepanidotænia liguloides (Gervais, 1847) Cohn, 1900.
Hymenolepis caroli (Par., 1887) Parona, 1900.
Weinlandia liguloides (Gervais, 1847) Mayhew, 1925.
Diorchis occlusa Linstow, 1906.
Amabilia lamelligera Linstow, 1879.

From the flamingo (*Phœnicopterus roseus*); Weligatta, Ceylon. ? Willey; and the Zoological Gardens, Calcutta. Southwell.

The worm attains a length of 7·5 cm. and a breadth of about 1 mm. ; the body is ovate in cross-section. All the segments are broader than long. Linstow stated that genital pores were absent, but they are present and are unilateral, situated at the extreme anterior corner of the lateral margin of the segment. The scolex is somewhat triangular in shape and has a diameter of about 530 μ. It is armed with 8 hooks, each having a length of from 110 to 130 μ. The ventral excretory vessel is much larger than the dorsal. The longitudinal muscles are well developed, and consist of a series of rather small, closely set bundles. Of the three testes, one is poral and the other two aporal. The cirrus sac extends

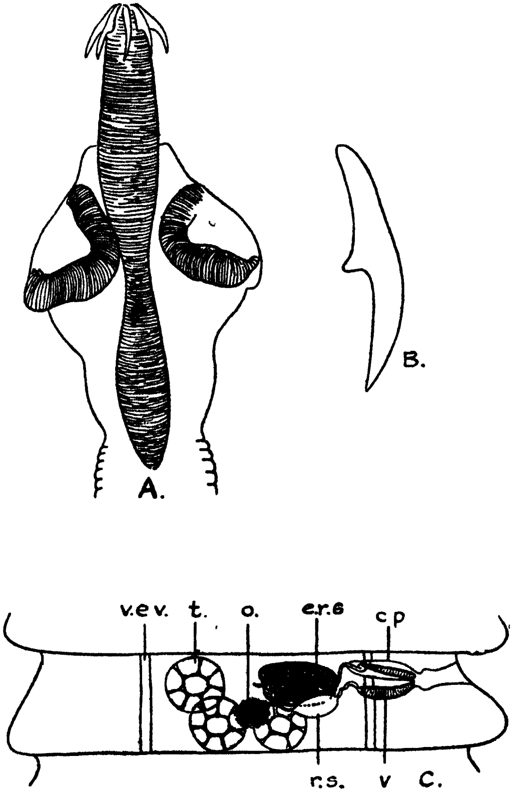


Fig. 298.—*Hymenolepis liguloides.* A, head, × 60 ; B, rostellar hook, × 270 ; C, mature segment, × 100. (Original.)

beyond the ventral excretory vessel to the aporal testis; it contains an internal vesicula seminalis; the external vesicula seminalis is conspicuous and extends to the level of the vitelline gland. The cirrus sac lies dorsally to the vagina, and both genital ducts are situated dorsally to the excretory vessels. The ovary is slightly aporal and lies ventrally to the vitelline gland; the latter organ is median and presents a somewhat follicular appearance. The vagina terminates at the pore in a conspicuous sacculus accessorius. Internally there is a large receptaculum seminis situated dorsally to the ovary. The size of the egg is not known.

(15) **Hymenolepis furcata** (Stieda, 1862). (Fig. 299.)

Synonyms:—*Tænia furcata* Stieda, 1862.
Weinlandia furcata (Stieda, 1862) Mayhew, 1925.
Lepidotrias furcata (Stieda) Cohn, 1899.

From *Crocidura murina*; Rangoon. Meggitt.

The worm attains a length of 1·5 cm. and a breadth of 250 μ. The genital pores are situated in the centre of the margin of the segment. The scolex has a diameter of 125 μ and the rostellum of 70 μ. The latter extends to, or beyond, the posterior margins of the suckers and bears 25 hooks, each of which has a length of from 19 to 24 μ.

Male Genitalia. There are three testes, one being poral and two aporal; of the two latter the anterior testis lies internally to the posterior one. The cirrus sac measures from 44 to 56 μ by 17 μ, and extends a quarter of the breadth of the segment.

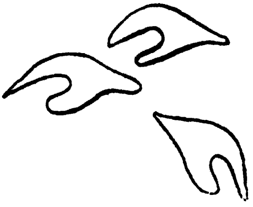


Fig. 299.—*Hymenolepis furcata.* Rostellar hooks, × 500. (After Meggitt, in 'Parasitology.')

Female Genitalia. When fully mature the ovary occupies the entire breadth of the segment; near the genital pore the vagina dilates into a terminal swelling which communicates by means of a narrow portion with a large, central, globular receptaculum seminis. The uterus is rectangular and fills the whole segment; dorsally, but not ventrally, it is divided by a partition into two almost equal halves.

(16) **Hymenolepis medici** (Stossich, 1890) Fuhrmann, 1906. (Fig. 300.)

Synonyms:—*Tænia medici* Stossich, 1890.
Weinlandia medici (Stossich, 1890) Mayhew, 1925.

From *Pelicanus philippensis*; Zoological Gardens, Calcutta. Southwell.

The worm has a length of about 1·5 cm. and a breadth of 500 μ; all the segments are broader than long except the posterior ones, which are square. The latter measure 500 μ. The unilateral pores are situated near the middle of the segment. The head has a length of about 200 μ and a breadth of 340 μ.

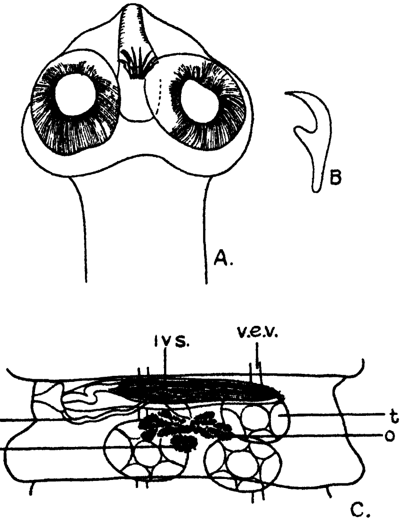


Fig. 300.—*Hymenolepis medici.* A, head, × 90; B, rostellar hook, × 400; C, mature segment, × 127. (Original.)

The rostellum is armed with 22 hooks, which measure from 30 to 34 μ. Fuhrmann stated that he was unable to discover a ventral aporal excretory vessel, but this was present in the Indian specimens; on each side the ventral vessel is much larger than the dorsal.

Of the three testes, two are situated aporally, one in front of the other; the cirrus sac is very prominent and has a length of 180 μ; it extends more than halfway across the segment. Together with the vagina it opens into a conspicuous genital atrium. Fuhrmann stated that in his specimen the cirrus sac extended to the anterior aporal corner, and even into the preceding segment. This condition only occurs in the gravid segment of Indian specimens. Within the sac the vas deferens is coiled; a small internal and a large external vesicula seminalis are present, the latter being situated dorsally to the cirrus sac. Up to the present the female genital organs have not been described.

The ovary is a somewhat bilobed organ situated in the middle of the segment, posterior to the internal third of the cirrus sac; it has a breadth of 80 μ. Immediately posterior to it is an oval vitelline gland having a length of about 40 μ. The vagina opens posteriorly to the cirrus sac, its terminal part being dilated. The uterus develops as a curved, transverse, lobulated sac eventually filling the entire segment.

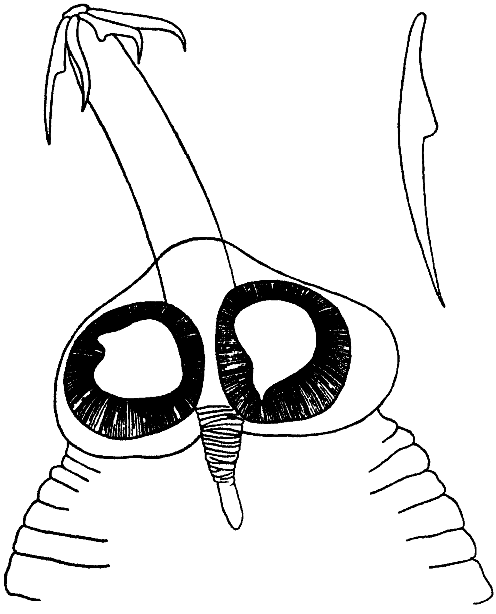


Fig. 301.—*Hymenolepis megalorchis*. Head, × 225; rostellar hook, × 500. (Original.)

(17) **Hymenolepis megalorchis** (Lühe, 1898). (Fig. 301.)

Synonyms:—*Tænia megalorchis* Lühe, 1898.
Drepanidotænia megalorchis (Lühe, 1898) Cohn, 1900.
Weinlandia megalorchis (Lühe, 1898) Mayhew, 1925.

From the flamingo (*Phœnicopterus roseus*); Zoological Gardens, Calcutta. Southwell.

The worm attains a length of about 8 mm. and a breadth of about 800 μ; it is composed of from about 35 to 50 segments, all of which are broader than long. The genital pores are

situated a little in front of the centre of the lateral margin of the segment. The head has a diameter of about 200 μ; the rostellum has a length of 120 μ and a breadth of 45 μ. It is armed with 8 hooks, each having a length of about 90 μ.

Of the three testes, two are situated aporally; the cirrus sac is extremely long and extends across the anterior part of the segment almost to the aporal excretory vessel.

The ovary and the vitelline gland lie between the two posterior testes and on the poral side of the aporal testis. The uterus is a large simple sac filling the segment.

(18) **Hymenolepis simplex** Fuhrmann, 1906. (Fig. 302.)

Synonym :—*Weinlandia simplex* (Fuhrmann, 1906) Mayhew, 1925.

From *Tadorna cornuta*; Zoological Gardens, Calcutta. Southwell.

The worm measures about 5 cm. in length and 800 μ in breadth. All the segments are broader than long. The head is armed with 20 hooks, each of which measures 12 μ.

Of the three testes, two are aporal, one being in front of the other; they are very large and, when fully developed, have a diameter of 150 μ. The cirrus sac is voluminous, extending to the aporal excretory vessel; it contains a very large vesicula seminalis. The sacculus accessorius has a diameter of 120 μ and is covered with minute spines.

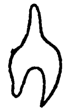


Fig. 302.—*Hymenolepis simplex*. Rostellar hook, magnification unknown. (After Lühe.)

The ovary is bilobed and has a diameter of 80 μ. Posteriorly to it is a compact vitelline gland having a diameter of 80 μ. The uterus is saccular and entirely fills the segment.

(19) **Hymenolepis zosteropis** Fuhrmann, 1918. (Fig. 303.)

Synonyms :—*Hymenolepis stylosa* of Southwell, 1922.
Weinlandia zosteropis (Fuhrmann, 1918) Mayhew, 1925.

From the following hosts, all obtained from the Zoological Gardens, Calcutta. Southwell :—

(1) The white-cheeked bulbul (*Criniger flaveolus*); (2) the green magpie (*Cissa chinensis*); (3) the eastern baya (*Ploceus passerinus*); (4) the crested bunting (*Melophus melanicterus*); (5) the tree-pie (*Dendrocitta* sp.); (6) the golden-backed woodpecker (*Brachypternus aurantius*); (7) the laughing-thrush

(*Trochalopterum meridionale*); (8) the magpie (*Pica rustica*) and (9) *Ploceus atrigula*.

The worm attains a length of about 2·2 cm. and a breadth of 700 μ. The posterior segments are somewhat bell-shaped and have a length of about 170 μ and a breadth of 700 μ. The unilateral genital pores are situated in the anterior third of the lateral margin of the segment. The scolex has a breadth of about 200 μ; the rostellar pouch extends to the posterior margin of the suckers. The rostellum is armed with 10 peculiarly shaped hooks arranged in a single row. In worms from *Ploceus atrigula* they measured about 36 μ in length, whilst in specimens from the other hosts they measured about 30 μ.

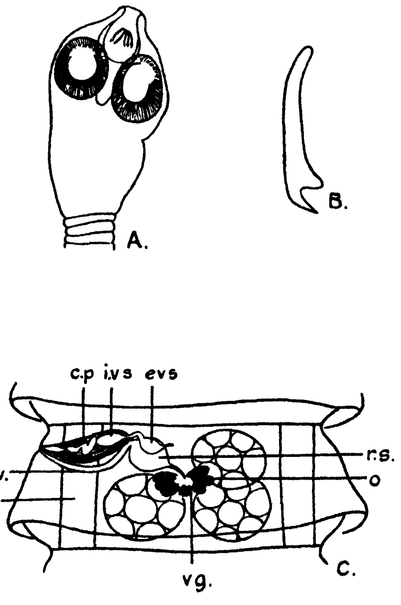


Fig. 303.—*Hymenolepis zosteropis.* A, head, × 64; B, rostellar hook, × 594; C, mature segment, × 64. (Original.)

The longitudinal muscles consist of two layers of bundles, the internal one being more strongly developed than the outer; they are disposed in 12 bundles dorsally and 12 bundles ventrally. The genital organs appear in segments about 6 mm. behind the head.

Of the three testes, two are situated aporally, one in front of the other. The cirrus sac extends in the median direction beyond the excretory vessel; it is club-shaped and measures from 120 to 140 μ. There is a conspicuous external seminal vesicle which has a length of 60 μ.

The ovary is slightly bilobed and has a breadth of about 160 μ. The vagina opens ventral to the cirrus sac; in the median direction it dilates into a receptaculum seminis which has a length of 70 μ. Immediately behind the ovary there is an oval vitelline gland having a diameter of 60 μ. The gravid uterus is a lobed sac entirely filling the segment. The egg is relatively large and measures about 60 μ in diameter; the oncosphere has a diameter of about 23 μ. Each uterus contains about 60 eggs.

(20) **Hymenolepis annandalei** Southwell, 1922. (Figs. 304 & 305.)

Synonym:—*Weinlandia annandalei* (Southwell, 1922) Mayhew, 1925.

From the black-tailed godwit (*Limosa belgica*); Barkuda, Chilka Lake, Orissa, India. Annandale.

The worm attains a length of 10·3 cm. and a breadth of 2 mm. Its anterior part is attenuated and whip-like; all the segments are broader than long, the posterior and lateral margins being salient. The genital pores are unilateral and are situated slightly anterior to the middle of the lateral margin. The head measures about 180 μ in length and has a breadth of 150 μ; the suckers have a diameter of about 80 μ. The rostellum is a conspicuous organ armed with a single row of 10 hooks, each of which measures about 32 μ in length; both in size and shape they closely resemble those of *H. brasiliense* Fuhrmann, 1906. The neck measures about 2 mm. in length.

The muscular system is feebly developed. The longitudinal muscles consist of an inner and an outer series of bundles, the former being situated immediately beneath the cuticle. A few circular fibres occur between the outer and inner longitudinal bundles and also internally to the inner longitudinal fibres. No oblique fibres have been noticed.

Details of the nervous system are not known. A small ill-defined nerve can be seen in transverse sections running externally to the water vessel on each side.

The excretory system consists of a single ventral vessel on each side, lying ventrally to the cirrus sac and vagina.

There are three testes: one is situated on the pore side and the other two are aporal, one being anterior to the other. When fully mature they have a diameter of about 150 μ, and occupy almost the whole of the segment dorso-ventrally. The cirrus sac lies dorsally to the vagina; it is somewhat club-shaped, the broader extremity being median. It measures about 180 μ in length and its greatest breadth is about 40 μ. Its central part is occupied by an internal seminal vesicle. In the median direction it continues as a very short, wide, coiled tube, and then dilates into a large external seminal vesicle which measures about 160 μ in length and 30 μ in breadth; the median extremity of the external seminal vesicle is close to the poral testis.

The ovary is situated in the middle line; it measures about 100 μ in the antero-posterior direction and has a breadth of 300 μ, whilst dorso-ventrally it practically fills that part of the segment. The vagina is a very muscular club-shaped organ measuring about 450 μ in length. At the pore its breadth is about 10 μ; it gradually widens, and attains a maximum diameter of 50 μ at a point opposite the middle of the external seminal vesicle; it then narrows gradually. The whole vagina functions as a receptaculum seminis. The vitelline gland is a conspicuous bilobed organ situated posteriorly to the centre of the ovary; it has a breadth of about 100 μ. The uterus is a simple transverse sac extending well beyond the excretory vessel on each side, and almost to the edge of the segment. The largest egg measures about 17 μ in diameter and the oncosphere 11 μ.

Fig. 304.

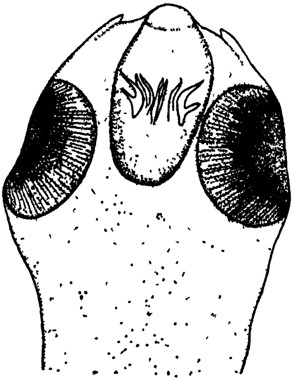
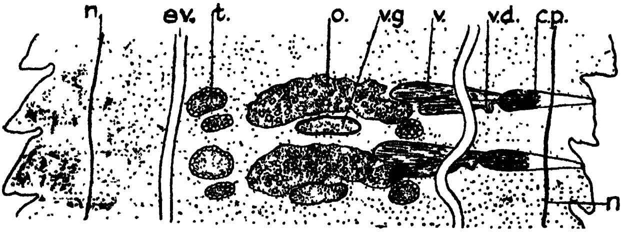


Fig. 305.



Hymenolepis annandalei.

Fig. 304.—Head, × 220. (After Southwell.)
Fig. 305.—Horizontal section of mature segments, × 60. (After Southwell.)

(21) **Hymenolepis rustica** (Meggitt, 1926).

Synonym :—*Weinlandia rustica* Meggitt, 1926.

From the domestic fowl ; Burma. Meggitt.

The worm varies in length from 4 mm. to 2·5 cm. and attains a maximum breadth of 6 mm. The unilateral pores are situated at the centre of the margin of the segment, sometimes slightly dorsal. The rostellum is unarmed and extends posteriorly to the centre of the suckers.

Of the aporal testes, one lies in front of the other ; the cirrus sac measures from 200 to 230 μ in length and reaches the aporal excretory vessel. The ovary almost touches the excretory vessel on each side. The uteri of the posterior proglottides are in communication with each other. This species resembles *H. carioca* (Magalhaes, 1898), but differs from it in having a larger cirrus sac and in the receptaculum seminis occupying a different position.

(22) **Hymenolepis ficticia** (Meggitt, 1927). (Fig. 306.)

Synonym :—*Weinlandia ficticia* Meggitt, 1927.

From a pelican ; Victoria Memorial Park, Rangoon. Meggitt.

The worm attains a length of from 1·5 to 2 cm. and a breadth of 200 μ. The genital pores are situated at the anterior third or quarter of the lateral margin of the proglottides ; a narrow genital atrium is present, but a sacculus accessorius is absent. The scolex has a diameter of from 170 to 200 μ ; the rostellum has a diameter of from 60 to 70 μ and extends nearly to the posterior margin of the suckers ; it is armed with a double crown of hooks, 24 in all, the large hooks, which measure from 48 to 52 μ, alternating with the smaller hooks, which measure from 44 to 49 μ. Ventral excretory vessels are present together with a large plexus on the ventral surface of the proglottis.

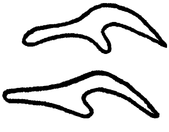


Fig. 306.—*Hymenolepis ficticia*. Rostellar hooks, × 585. (After Meggitt, in ' Parasitology.')

Male Genitalia. Of the three testes, all of which are close together and fill the dorsal surface of the segment, two are posterior ; the third is anterior, and either internal or external to the aporal posterior testes ; the cirrus sac measures from 140 to 160 μ by 28 to 44 μ in gravid segments, extending practically to the aporal excretory vessel, but not entering the preceding segment.

Female Genitalia. The ovary is ventral to the testes; at first it is lobed, then horse-shoe-shaped. A large receptaculum seminis is present, filling two-thirds of the space, ventrally, between the excretory vessels. In the posterior segments there are found large granular bodies almost the size of the testes, some of which appear to be remains of either the degenerating receptaculum seminis or vesicula seminalis.

This species is very similar to *Weinlandia medici* (Stossich, 1890), but differs in having two sizes of hooks, an aporal excretory vessel, and a cirrus sac confined to one segment.

(23) **Hymenolepis minutissima** (Meggitt, 1927). (Fig. 307.)

Synonym:—*Weinlandia minutissima* Meggitt, 1927.

From *Crocidura murina*; Rangoon. Meggitt.

The worm measures only 2 mm. in length and attains a breadth of 150 μ. It should be noted, however, that gravid segments have not been obtained. The scolex has a diameter of from 120 to 125 μ; the rostellum has a diameter of 46 to 75 μ and extends beyond the posterior margins of the suckers; it is armed with 12 hooks, each of which has a length of from 16 to 18 μ. The cirrus sac extends inwardly beyond the excretory vessels.

Fig. 307.

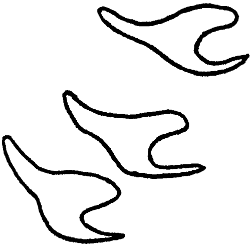


Fig. 308.

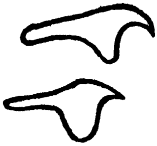


Fig. 307.—*Hymenolepis minutissima.* Rostellar hooks, × 500. (After Meggitt, in 'Parasitology.')

Fig. 308.—*Hymenolepis solitaria.* Rostellar hooks, × 500. (After Meggitt, in 'Parasitology.')

(24) **Hymenolepis solitaria** (Meggitt, 1927). (Fig. 308.)

Synonym:—*Weinlandia solitaria* Meggitt, 1927.

From *Crocidura murina*; Rangoon. Meggitt.

This species only differs from *H. minutissima* in the fact that the rostellum is armed with 16 hooks, each of which measures 16 or 17 μ in length.

(25) Hymenolepis phalacrocorax (Woodland, 1929). (Fig. 309.)

Synonym :—*Weinlandia phalacrocorax* Woodland, 1929.

From the large cormorant (*Phalacrocorax carbo*) ; Chitrakot, United Provinces, India. Woodland.

The worm attains a length of about 12 cm. and a maximum breadth of 1·5 mm. The scolex is unarmed and has a diameter of about 330 μ. The genital pores are unilateral and are situated on the left side. The genital ducts pass dorsally to both the excretory vessels and nerve.

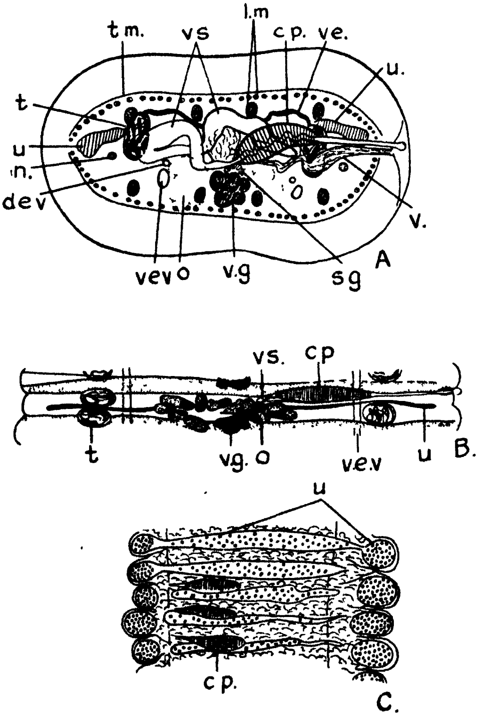


Fig. 309.—*Hymenolepis phalacrocorax.* A, transverse section of mature segment, × 37 ; B, mature segment, × 37 ; C, horizontal section of gravid segments, × 26. (After Woodland, in 'Parasitology.')

Muscular System. The longitudinal muscle bundles are in two concentric layers, the inner one consisting of four dorsal and four ventral bundles, whilst the outer consists of from 60 to 80 small bundles. The circular muscle fibres lie externally to the longitudinal muscle bundles.

Excretory System. There are two excretory vessels running along each lateral margin of the worm ; each pair lies internally to the row of testes on the same side. Dorso-ventrally the two lateral vessels are in apposition, and apparently never communicate with each other posteriorly.

Male Genitalia. The worm is peculiar in that all the three testes are situated externally to the excretory vessels, one being poral and the other two aporal (one behind the other). The cirrus sac is large and divided into a small external portion provided only with longitudinal muscles for the protrusion of the cirrus, and a large internal portion provided only with circular muscles for the propulsion of the spermatozoa. The cirrus is unarmed. The whole of the vas deferens outside the sac is converted into a vesicula seminalis; it is long, wide, coiled upon itself, and situated slightly ventrally to the internal portion of the sac, but it receives the three vasa efferentia dorsally.

Female Genitalia. The ovary is large and bilobed, and immediately behind and ventrally to it is the vitelline gland. The large median shell gland is situated ventrally to the inner end of the vagina and dorsally to the isthmus. The vagina opens ventrally to the cirrus sac, and its terminal part is slightly dilated; it then narrows until it reaches the excretory vessels, when it broadens again and runs backwards to the dorsal surface of the ovary.

The uterus is a transverse sac extending to the margins of the segment, and having dilated extremities.

(26) Hymenolepis clerci Fuhrmann, 1924.

Synonyms:—*Hymenolepis interruptus* Clerc, 1906. (Apparently not *Hymenolepis interrupta* (Rud., 1802) Fuhrmann, 1906.)
Wardium clerci (Fuhrmann, 1924) Mayhew, 1925.

As the specific name *interrupta* was preoccupied by Rudolphi's species, Fuhrmann (1924) changed the name of Clerc's species to *H. clerci*.

H. interrupta (Rudolphi, 1802) Fuhrmann, 1906, is referred by Mayhew to the genus *Weinlandia*; whilst *H. interruptus* Clerc, 1906 (=*H. clerci* Fuhrmann, 1924) is placed by him in the genus *Wardium*. The distinction between Rudolphi's species and Clerc's species is not well defined. In both the hooks are approximately the same size and have almost the same shape; the testes have the same distribution. Rudolphi's species attains a length of about 10 cm. and occurs in Charadriformes, whilst Clerc's measures 3·5 to 4 cm. and is found in sparrows (Passeriformes).

From *Passer montanus*; Rangoon. Meggitt.

The worm measures from 3·5 to 4 cm. in length and has a breadth of 570 μ. The segments are all broader than long except a few of the most posterior. The genital pores are unilateral and are situated slightly in front of the middle of the lateral margin of the segment.

The scolex, according to Meggitt, has a length of from 166 to 180 μ, but Clerc states that it measures 450 μ. The rostellum has a length of 128 μ and a breadth of 60 μ. The rostellar hooks each measure from 20 to 24 μ and are arranged in a single row. A short neck is present, its length varying with the degree of contraction of the worm.

Muscular System. The longitudinal muscles consist of two layers separated by discontinuous circular fibres. The outer longitudinal muscle layer consists of small fibres closely set together; the inner layer, according to Meggitt, consists of from 18 to 20 very much larger ones, separated by large intervals; Clerc, however, gives a much lower number, namely, 8. At the junction of the proglottides there is a sheet of numerous strong transverse muscles together with weaker dorso-ventral fibres.

Excretory System. There are two longitudinal vessels, one dorsal and one ventral, running along each side of the worm; they bend outwardly in the centre of each segment and inwardly at the junction of the segments. The dorsal and ventral vessels communicate with each other at the posterior margin of each segment. The dorsal vessel remains of the same width throughout the strobila, but the ventral vessel gradually increases in size until it becomes four times the diameter of the dorsal vessel.

Male Genitalia. The testes are situated dorsally, one being poral, the other two aporal; of the latter, one is situated anterior to and a little external to the other; all three testes lie within the excretory vessels. When the strobila is strongly contracted the three testes may occasionally lie almost in a straight line. The cirrus sac is small and cylindrical, extending just median to the dorsal excretory vessel; it measures 89 by 25 μ and is situated dorsally to the nervous and excretory vessels; its inner end is occupied by a large internal seminal vesicle; it opens dorsally into a small genital atrium. The cirrus is unarmed. The vas deferens is cylindrical and curved, having the concavity directed ventrally; it dilates into a vesicula seminalis and then splits into three vasa efferentia.

Female Genitalia. The ovary is ventral and median, extending laterally nearly to the ventral excretory vessel. The vagina opens into a genital atrium ventrally; near the internal vesicula seminalis it widens considerably into a receptaculum seminis which is situated anteriorly in the poral half of the segment; it measures about 100 μ in length by 60 μ in breadth. The vitelline gland is spherical and is situated in the posterior concavity of the ovary. The shell gland consists of glandular cells surrounding the oviduct. The uterus at first is a narrow band lying transversely and dorsally to the ovary. It subsequently develops two ventral wings, and its cavity becomes divided by septa which arise from its walls. Eventually the two wings coalesce and the uterus becomes sac-like, extending beyond the excretory vessels. The oncosphere measures from 34 to 38 μ by 29 μ and the embryonic hooks 9 to 14 μ.

SPECIES INQUIRENDÆ.

(1) **Hymenolepis** sp. (? *H. collaris* Batsch, 1786) Fuhrmann, 1908 = *H. sinuosa* Cohn, 1901.

From *Anas pœcilorhyncha*; Zoological Gardens, Calcutta. Southwell.

A number of specimens, all without a scolex, have been recorded from the above host. The worms measured from 6 to 8 cm. in length and the greatest breadth was 2 mm. The posterior segments were as long as broad, and some of the anterior segments were bell-shaped and much longer than broad—almost certainly an artificial condition.

Each segment contains three testes and each one is lobed; one testis is situated on the pore side and the other two aporally, one being directly anterior to the other. The ovary lies between the poral testis and the aporal testes. The accessory sac is well developed.

(2) **Hymenolepis fasciata** (Rudolphi, 1810) ? Krabbe, 1869.

From ducks; Madras. Southwell.

According to Krabbe (1869), it is impossible to state definitely which particular cestode from the goose is referred to under the specific name *fasciata*, but he restricted the species to those cestodes which are provided with 8 hooks on the rostellum, found in geese. Apparently the *Tænia fasciata* of Rudolphi, 1810, is the same as *T. setigera* Fröhlich, 1789.

Mayhew (1925), however, includes *H. fasciata* (Rudolphi, 1810) under "*Species inquirendæ.*" The writer in 1922 referred to the species *H. fasciata* a worm obtained from the above host. It was so named because the head was armed with a simple crown of hooks and it agreed generally with the description given by Stiles and Hassall (1896). The identity of the parasite is, however, uncertain.

(3) **Hymenolepis** sp. (? *microcephala* (Rudolphi, 1819) Fuhrmann, 1906.)

From the white stork (*Ciconia alba*); Zoological Gardens, Calcutta. Southwell.

The specimens were so badly preserved that it was impossible to make any definite statement beyond the fact that they belonged to the genus *Hymenolepis*.

(4) **Hymenolepis capillaroides** Fuhrmann, 1906.

Synonym :—*Wardium capillaroides* (Fuhrmann, 1906) Mayhew, 1925.

From a snipe ; Berhampur, Bengal. Southwell.

The worms recorded by Southwell from the above host have unfortunately been lost, and it is therefore impossible to check this diagnosis.

(5) Gaiger (1915) recorded an undetermined species of ? *Hymenolepis* from the dog. It is improbable that the worm belongs to this genus.

(6) **Hymenolepis** sp. Southwell, 1916.

Synonym :—*Diorchis americana* of Southwell, 1916.

From (1) the domestic fowl and (2) *Dendrocitta* sp. ; Zoological Gardens, Calcutta. Southwell.

The worm attains a length of 2·5 cm. and a breadth of 600 μ. The genital pores are situated at the centre of the lateral margin of the segment. The rostellum is armed with 10 hooks, each having a length of about 65 μ.

(7) **Hymenolepis** sp. Southwell, 1916.

From the black Australian swan (*Chenopis atrata*) ; Berhampur, Bengal. Southwell.

A number of specimens measuring 1·7 cm. in length and 600 μ in breadth, all without a head and badly preserved, have been recorded from the above host. Specific determination cannot be arrived at.

The cirrus sac in these worms was enormous, extending two-thirds across the segment. The cirrus was very long and covered with minute spines.

(8) **Hymenolepis** sp. Southwell, 1916.

From a woodpecker (*Chrysophlegma flavinucha*) ; Zoological Gardens, Calcutta, India. Southwell.

The specimens measured 2·5 cm. in length and were extremely delicate. They were so badly preserved that a specific diagnosis was impossible.

(9) **Hymenolepis** sp. (? *asymmetrica*) Fuhrmann, 1918.

From the red-billed blue magpie (*Urocissa occipitalis*) ; Zoological Gardens, Calcutta. Southwell.

The worm measured 10 mm. in length and was immature. Its identity is quite uncertain.

(10) **Hymenolepis** sp. Southwell, 1922.

From *Emberiza luteola* ; Zoological Gardens, Calcutta. Southwell.

Numerous fragments, without heads, in a bad state of preservation, have been recorded from the above host. The segments each contained three testes.

(11) **Hymenolepis** sp. Southwell, 1922.

From *Phalacrocorax carbo* ; Chilka Lake, Orissa. Southwell.

A few fragments and a damaged head from the above host could not be definitely identified. They appeared, however, to resemble *H. breviannulata* Fuhrmann, 1906. fairly closely.

It is unlikely, however, that the specimens belong to this species, which occurs in the Somaliland ostrich (*Struthio molybdophanes*).

(12) **Hymenolepis** sp. Southwell, 1922.

Synonym:—*Hymenolepis naja* of Southwell, 1922; not Dujardin, 1845.

From a magpie (*Copsychus saularis*) ; Zoological Gardens, Calcutta. Southwell.

The worm measures about 10 mm. in length and has a breadth of about 200 μ. All the segments are broader than long, and the unilateral genital pores are situated in front of the middle of the lateral margin of the segment. The head is armed with 10 hooks, each having a length of about 30 μ. Of the three testes, two are situated aporally. It is impossible to determine definitely to which species the worm belongs.

(13) **Hymenolepis** sp. Southwell, 1922.

Synonym :—*Choanotænia* (? *octocantha* Krabbe, 1869) of Southwell, 1922.

From a snipe ; Berhampur, Bengal. Southwell.

Two badly preserved specimens recorded from the above host resembled in some detail the species described by Krabbe from *Anas boschas* under the name *H. octocantha*. It is, however, improbable that the species from the snipe is the same, although closely related.

(14) Moghe (1926) recorded an undetermined species of *Hymenolepis* from a rat ; it is probably *H. murina* or *H. diminuta*.

(15) **Hymenolepis** sp. Joyeux & Houdemer, 1928.

From pigeons ; Kasauli, India. Korke.

Incomplete specimens. The largest measured 6·6 cm. in length and 500 μ in breadth ; all the worms were without heads and all the segments were immature. The musculature was well developed ; the longitudinal muscles are in two concentric irregularly scattered bundles. The transverse muscles are difficult to see; the ventral water vessel is large. Testes three; of these, one is poral and two aporal. External seminal vesicle turns towards the cirrus sac; the latter is two-thirds the width of the segment. Internal seminal vesicle large; cirrus armed. Vas deferens and vagina dorsal to both vessels. Vagina anterior to the vas deferens; it crosses the pouch and then dilates into a receptaculum seminis.

The worm resembles *Hymenolepis serrata* Fuhrmann, 1906, but differs in the position of the testes, which place it in the genus *Weinlandia*. Further, the cirrus sac is shorter in *H. serrata* than in the species from Kasauli.

Subgenus **ECHINOCOTYLE** Blanchard, 1891.

Rostellum armed with a single crown of ten slender hooks, with dorsal root and blade about equal in length and ventral root rudimentary. Suckers large, flat, armed on the border and in the middle with small hooklets. A sacculus accessorius always present. Adults in birds.

Type-species :—*Echinocotyle rosseteri* Blanchard, 1891.

Key to Species.

Rostellar hooks each 30 to 38 μ in length	*E. rosseteri*, p. 149.
Rostellar hooks each about 66 μ in length........	*E. uralensis*, p. 150.

(1) **Echinocotyle rosseteri** R. Blanchard, 1891. (Fig. 310.)

From domestic ducks; Bengal. Blanchard.

The worm attains a length of about 1·5 mm. and a breadth of 180 μ; it is composed of about 26 segments. The genital pores are unilateral and are situated anteriorly on the lateral margin of the segment. The head is subspherical, measuring from 85 to 155 μ in length by 75 to 105 μ in breadth. The rostellum is long and armed with a single crown of hooks, each measuring from 30 to 38 μ in length. Each of the four suckers is armed with three series of minute hooks. The cirrus sac is large and conspicuous, extending halfway across the segment. No specimens have been obtained in which the female genital organs were developed.

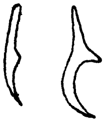


Fig. 310.—*Echinocotyle rosseteri*. Hooks, magnification unknown. (After Blanchard.)

This species was recorded by Rosseter from ducks imported from Bengal into Europe; there is some uncertainty as to whether the ducks were infected in Bengal or Europe. Cysticercoids occur in copepods, such as *Cypria ophthalmica* and *Cyclocypris globosa*.

(2) **Echinocotyle uralensis** Clerc, 1902. (Fig. 311.)

From (1) Snipe; Potsengbam, Loktak Lake, Manipur, Assam. Southwell. (2) Snipe (*Capella* sp.); Berhampur, Bengal. Southwell.

The worm attains a length of about 4 cm. and a breadth of 1·2 mm. The segments are all longer than broad, and the genital pores are situated in the anterior part of the lateral margin of the segment. The head bears a long rostellum armed with 10 hooks, each measuring 66 μ. The suckers are strongly developed and are armed with a large number of minute hooks arranged in rows as in *E. rosseteri*.

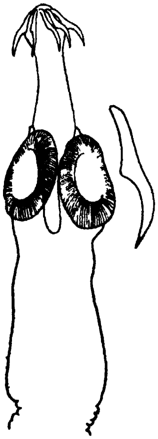


Fig. 311.—*Echinocotyle uralensis.* Head. × 90; rostellar hook, × 240. (Original.)

The musculature consists mainly of longitudinal fibres which are arranged in a double layer of bundles.

There are three testes arranged in the form of a shallow V, the apex pointing posteriorly. The vas deferens dilates into a rather elongated seminal vesicle. The cirrus sac is relatively small. A sacculus accessorius is always present.

The ovary is bilobed and situated ventrally; immediately posterior to it is a simple, somewhat globular vitelline gland. The shell gland is minute and lies dorsally to the ovary. The vagina lies dorsally to the cirrus sac and dilates into an enormous receptaculum seminis. The uterus is a sac with irregular walls.

Genus II. FIMBRIARIA Fröhlich, 1802.

Scolex small and usually lost, with rostellum armed with a single row of hooks. Strobila without true segments but with transverse grooves, giving the appearance of segments. Pseudoscolex retains the true segmentation. Excretory system consists of several pairs (three and eleven in the two known species) of longitudinal excretory vessels. Genital pores marginal, unilateral, and on the right-hand border of the strobila. Testes three in number for each cirrus sac. Ovary reticular, or forming network extending through the strobila, or a simple ovary for each set of reproductive organs. Uterus reticular.

Type-species :—*Fimbriaria fasciolaris* (Pallas, 1781).

Fimbriaria fasciolaris (Pallas, 1781) Wolff, 1900. (Fig. 312.)

Synonyms :—*Fimbriaria malleus* (Goeze, 1782) Fröhl., 1802.
?*Fimbriaria mitra* Fröhl., 1802.
Fimbriaria mitrata Blainville, 1828, and Nordmann, 1840.
Fimbriaria plana Linstow, 1905.
Notobothrium articum Linstow, 1905.

From (1) *Fuligula cristata* ; Loktak Lake, Assam. Southwell. (2) Ducks ; Rangoon. Meggitt.

The worm measures from 2·5 to 42·5 cm. in length and has a maximum breadth of 5 mm. The external segmentation is somewhat indistinct, being obscured by rugosities, and the reproductive organs appear not to be definitely segmented. The true head is very small and extremely unstable, being almost always lost ; but when present it is armed with a single row of 10 hooks, each of which measures from about 17 to 22 μ. When lost, the head is replaced by a pseudoscolex. This consists of the modified anterior part of the strobila, usually lying at an angle with the rest of the worm. It may measure up to 5 mm. in length and contain as many as 200 segments, each one representing from 4 to 12 separate segments which have fused together. They do not contain genital organs. In the absence of the true head the explanation of the manner in which the worm grows presents certain difficulties.

Muscular System. This is well developed. The longitudinal muscles consist of a single layer of rather large bundles lying immediately external to the well-developed circular muscles ; dorso-ventral fibres are also well developed.

Male Genitalia. Each apparent segment contains 18, 21, or 24 testes irregularly disposed, with 6, 7, or 8 cirrus sacs respectively, indicating that each apparent segment is formed by the fusion of 6, 7, or 8 segments, and that, like the species of the genus *Hymenolepis*, each true segment contains three testes.

The cirrus sac is a large, prominent, muscular structure containing an internal seminal vesicle. The cirrus is strongly armed with powerful hooks. An external seminal vesicle is also developed.

Female Genitalia. The ovaries are in the form of transverse tubes occupying the whole length of the parenchyma, close together. Fuhrmann states that there is a single cylindrical and continuous ovary throughout the strobila. From this common ovary arise hundreds of oviducts; on the vagina is developed a large receptaculum seminis in the form of an undulating tube. The vitelline glands are lobed and do not appear to fuse; the uterus at first has the same shape as the ovary, *i. e.*, it is composed of a transverse tube which is situated ventrally to the ovary. It gives off evaginations

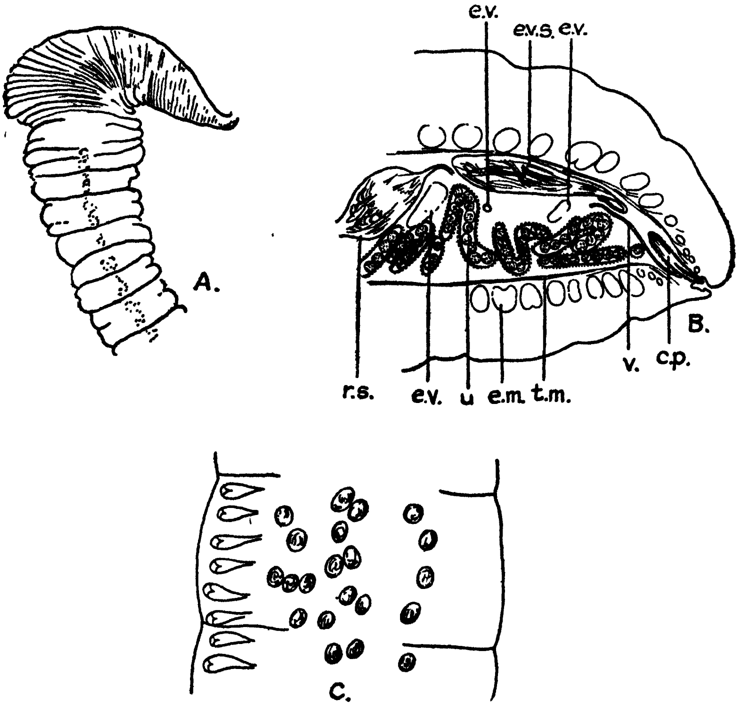


Fig. 312.—*Fimbriaria fasciolaris.* A, pseudoscolex; B, transverse section of poral side of segment; C, segments showing the number of testes (18) in relation to cirrus pouches (6). Magnification unknown. (After Fuhrmann.)

dorsally into the parenchyma; each one contains several eggs. Normally the eggs pass into these vertical ramifications, and in the meantime the uterine cavity becomes reticulated. The gravid strobila contains one single continuous uterus which opens to the exterior by numerous apertures situated on both sides of the median line and irregularly disposed. The egg measures up to 80 μ in diameter; larval forms occur in the Ostracod *Diaptomus vulgaris*.

Family V. DILEPIDIDÆ Railliet & Henry, 1909.

Synonym:—Dilepinidæ Fuhrmann, 1907.

Scolex furnished with a retractile rostellum armed with one or more rows of hooks, rarely unarmed. Genital organs single or double. Genital pores marginal and either single or double; in the first case they may be unilateral, or regularly or irregularly alternate. Testes more or less numerous, not less than six in each segment. Uterus very variable in form. Oncosphere with three envelopes.

Type-genus:—*Dilepis* Weinland, 1858.

Meggitt (1924) writes: "As the genus *Dilepis*, after which Fuhrmann named his subfamily, differs from the majority of the other genera in several respects (unilateral genital pores instead of alternating, genital ducts pass dorsally instead of between longitudinal excretory vessels, testes occasionally reduced to 7), I suggest *Anomotænia* as the type, it corresponding more nearly to the average genus in this subfamily." In 1927 he further draws attention to the fact that the species of "*Dilepis*, type-genus of the subfamily Dilepininæ, sometimes has only 7 testes; the pores are unilateral and the genital ducts pass dorsally to the excretory vessels, whilst in the remainder of the subfamily eight genera have unilateral pores and 14 genera alternating pores. Further, in twelve genera the genital ducts pass between the vessels, whilst in five genera they are dorsal to them; and all these genera have numerous testes, at least twelve."

In 1927 he pointed out that there are four genera with similar characteristic hooks, viz., *Biuterina* Fuhrmann, 1902; *Cyclorchida* Fuhrmann, 1907; *Deltokeras* Meggitt, 1927; and *Sphæruterina* Johnston, 1914. The first and last have a paruterine organ, whilst in the other two the uterus is persistent. Fuhrmann considers that *Sphæruterina* is a synonym of *Biuterina*, the only difference between these two genera being the number of testes. Following precedents "where condition of uterus is subordinated to armature of the scolex," Meggitt erects a new family for the reception of these genera, viz. :—

Family Biuterinidæ. Rostellum armed with triangular hooks.

Subfamily 1. Biuterininæ Meggitt, 1927. Uterus replaced by paruterine organ. Type-genus :—*Biuterina* Fuhrmann, 1902.

Subfamily 2. Deltokerinæ Meggitt, 1927. Uterus persistent. Type-genus :—*Deltokeras* Meggitt, 1927.

It will be noted that the only character ascribed to the family is the possession of characteristic hooks. It is true that such precedents do exist; the family Davaineidæ, for instance, may be said to be characterized by the shape and size of the hooks on the rostellum. Whether Meggitt's proposed new family stands or not depends on whether the shape of a hook is to be considered of greater systematic value than a paruterine organ. If the new family is accepted, then a complete revision of the classification of the family Dilepididæ will be necessary. Under the circumstances it appears to the writer desirable to retain the older classification and to place Meggitt's genus *Deltokeras* (correctly *Deltoceras*) in the subfamily Dilepininæ (correctly Dilepidinæ) Fuhrmann, 1907.

Key to Subfamilies.

Uterus persistent	**Dilepidinæ**, p. 154.
Uterus breaks up into egg capsules..........	**Dipylidiinæ**, p. 175.
Uterus with one or more paruterine organs ..	**Paruterininæ**, p. 184.

Subfamily I. DILEPIDINÆ Fuhrmann, 1907.

Rostellum armed with a double or single row of hooks, or unarmed (*Unciunia*). Genital pores usually pass between the dorsal longitudinal excretory vessels. Testes numerous. Uterus sac-like, more or less lobed, occasionally ring-shaped (*Cyclustera*) or divided by septa (*Bancroftiella*), never replaced by egg-capsules.

Type-genus :—*Dilepis* Weinland, 1858.

Key to Genera.

1. Rostellum armed with a single row of hooks	2.
Rostellum armed with a double row of hooks	3.
Rostellum unarmed (?)................	PENTORCHIS, p. 171.
2. Genital pores unilateral	LATERIPORUS, p. 157.
Genital pores regularly alternate........	AMŒBOTÆNIA, p. 165.
Genital pores irregularly alternate	CHOANOTÆNIA, p. 159.

3. Genital pores unilateral	4.
Genital pores irregularly alternate	5.
4. Cirrus armed with powerful spines	GRYPORHYNCHUS, p. 170.
Cirrus not armed with powerful spines	6.
5. External segmentation distinct, ovary symmetrical	ANOMOTÆNIA, p. 163.
External segmentation indistinct, ovary poral	PARVIROSTRUM, p. 167.
6. Genital canals pass dorsally to longitudinal excretory vessels	DILEPIS, p. 155.
Genital canals pass between longitudinal excretory vessels	7.
7. Testes surrounding female genitalia	CYCLORCHIDA, p. 173.
Testes posterior and lateral to female genitalia	DELTOCERAS, p. 172.

Genus I. **DILEPIS** Weinland, 1858.

Rostellum armed with a double crown of hooks, each with long dorsal and short ventral root and long blade. Genital pores unilateral; genital canals pass dorsally to longitudinal excretory vessels and nerve; testes surrounding the female glands laterally and posteriorly, typically numerous (40 to 50), but may be reduced in number (7). Uterus sac-like, with few or numerous out-pocketings. Adults in birds.

Type-species :—*Dilepis angulata* (Rudolphi, 1810) Cohn, 1899.

(1) **Dilepis campylancristrota** (Wedl, 1855) Fuhrmann, 1908. (Fig. 313.)

Synonym :—*Tænia campylancristrota* Wedl, 1855.

From (1) The paddy-bird (*Herodias garzetta*); Berhampur, Bengal. Southwell. (2) The pond-heron (*Ardeola grayi*); Zoological Gardens, Calcutta. Southwell.

The worm is very small, attaining a maximum length of 7 mm. only and a breadth of 500 μ. It consists of from 20 to 30 segments, the last ones measuring about 220 μ in length and 240 μ in breadth. The genital pores are unilateral and are situated in the anterior third of the lateral margin of the segment. The head has a length of about 80 μ and a breadth of 143 μ. The suckers have a diameter of about 42 μ. The rostellum is armed with about 20 hooks arranged in a double row; those in the anterior row have a length of from 22 to 30 μ and those in the posterior row of from 7 to 12 μ. There is no neck.

There are about seven or eight testes, which increase considerably in size; of these, three are situated in the middle of the segment behind the ovary and four aporally. The cirrus sac extends more than half the distance across the segment. The cirrus is armed with minute spines.

The ovary is bilobed and is situated in front of the testes. The uterus is a simple sac at first, consisting of two spherical sacs communicating with each other.

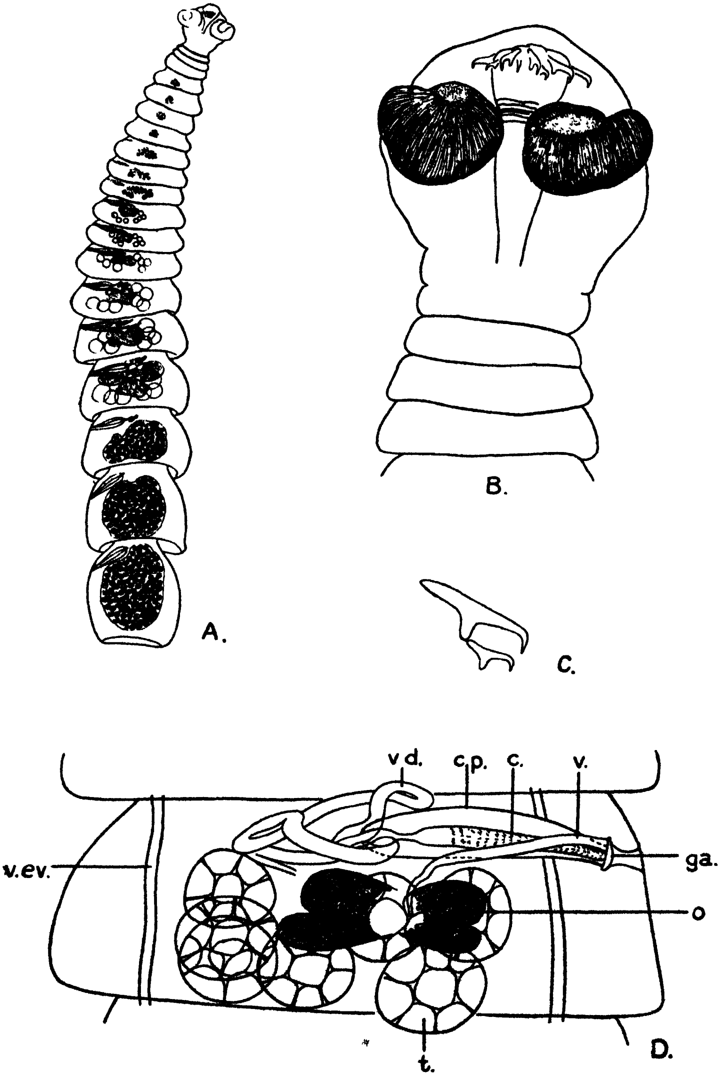


Fig. 313.—*Dilepis campylancristrota.* **A, entire worm, ×47; B, head, ×240; C, rostellar hooks, × 530; D, mature segment, × 200. (Original.)**

(2) **Dilepis** sp.

Under the name *Dilepis cypselina* Neslobinsky, 1911, Southwell recorded a fragment and a head of a worm from the intestine of a tree-pie (*Dendrocitta leucogaster*); Zoological Gardens, Calcutta.

The head was armed with a double crown of hooks, all of the same size, and measuring about 18 μ. They were peculiar in that they were rose-thorn-shaped, and resembled fairly closely the hooks on the head of species of *Dipylidium*. The genital pores were unilateral and the cirrus sac was situated anteriorly, extending almost to the longitudinal excretory vessels.

The species is probably new, but in the absence of material it has been thought undesirable to erect a new species.

Genus II. **LATERIPORUS** Fuhrmann, 1907.

Rostellum with a single crown of from 12 to 16 hooks, with long dorsal and short ventral roots and well-developed blade. Genital pores unilateral. Genital canals pass dorsally to longitudinal excretory vessels. Testes 12 to 30, posterior or lateral to female glands. Uterus sac-like. Adults in birds.

Type-species :—*Lateriporus teres* (Krabbe, 1869).

(1) **Lateriporus spinosus** Fuhrmann, 1922. (Fig. 314.)

Synonym :—*Dilepis macrosphincter* Southwell, 1922.

From *Ardea purpurea*; Zoological Gardens, Calcutta. Southwell.

The specimens attain a length of about 10 cm. and a maximum breadth of about 2 mm. All the segments are broader than long and their posterior lateral corners are salient. The genital pores are unilateral and are situated at the extreme anterior angle of the lateral margin of the segment. In some segments the genital papilla is prominent.

Muscular System. The longitudinal muscles are not well developed; they consist of about 12 small internal bundles, external to which are a number of smaller bundles and separate fibres.

Excretory System. The dorsal excretory vessel is extremely small and difficult to see, but the ventral vessel is large and conspicuous. The genital ducts pass dorsally to the latter.

Male Genitalia. There are about 30 testes, although Fuhrmann gives the number as ? 6. They completely surround the female organs, but do not extend beyond the ventral excretory vessel. A vesicula seminalis is absent. The cirrus sac is very large and extends almost the to middle of the segment. Fuhrmann states that it may extend as far as the poral excretory vessel, but probably this only takes place when the segment is exceptionally elongated. Within the sac the vas deferens is much coiled; the cirrus is large and armed with long closely-set spines.

Female Genitalia. The ovary is a conspicuous bilobed organ, each half being transversely elongated and narrow

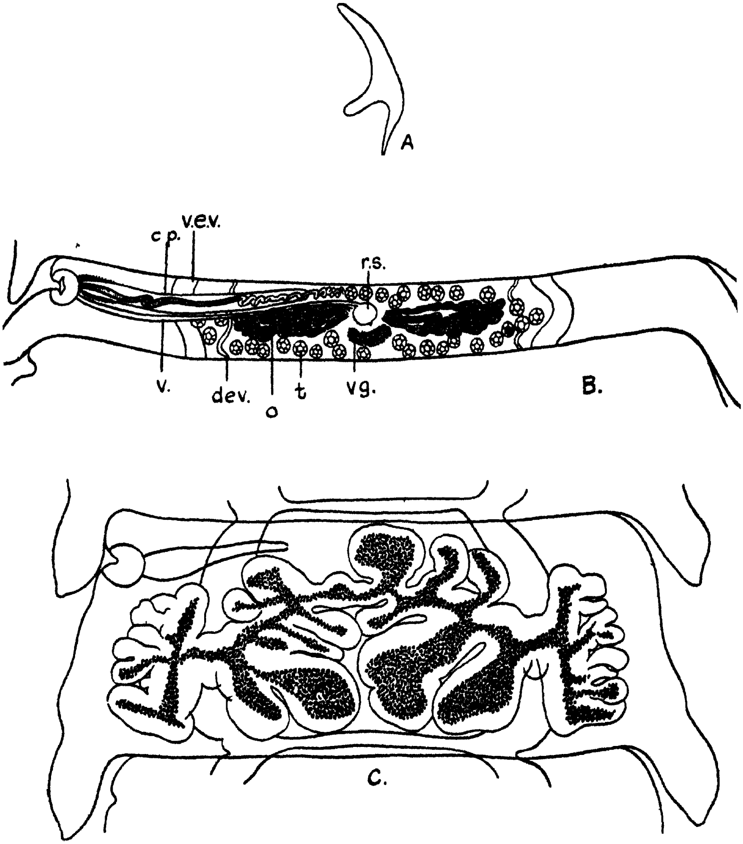


Fig. 314.—*Lateriporus spinosus.* A, rostellar hook, × 450; B, mature segment, × 60; C, gravid segment, × 60. (Original.)

antero-posteriorly; it is situated in the anterior part of the segment. Immediately behind it is the small vitelline gland. The vagina runs posteriorly to the cirrus sac; its terminal part is armed with fine hairs and it is very muscular. The remaining part of the vagina is narrow and only slightly undulated. Between the ovarian lobes it dilates into a small fusiform receptaculum seminis. The uterus is a sac filling the entire segment and extending laterally to the excretory vessels. The oncosphere has a diameter of about 16 μ.

Genus III. CHOANOTÆNIA Railliet, 1896.

Synonyms:—*Icterotænia* Railliet & Henry, 1909.
Parachoanotænia Lühe, 1910.

Rostellum with a single crown of hooks. Genital pores irregularly alternate. Genital ducts pass between the longitudinal vessels. Testes numerous, posterior. Uterus sac-shaped. Adults in birds and mammals.

Type-species :—*Choanotænia infundibuliformis* (Goeze, 1782).

Meggitt (1927) states that the three genera *Amœbotænia* Cohn, 1899; *Anomotænia* Cohn, 1900; and *Choanotænia* Railliet, 1896, are closely related, and that the characters separating them are insufficient for generic diagnosis; but, pending a complete revision, he retains them. The writer agrees with Meggitt's opinion.

Key to Species.

1.	Over 5 cm. in length	*C. infundibuliformis*, p. 159.
	Under 5 cm. in length	2.
2.	Head armed with more than 10 hooks	3.
	Head armed with less than 10 hooks	*C. decacantha*, p. 160.
3.	Cirrus pouch extending to middle of segment	*C. magnicirrosa*, p. 162.
	Cirrus pouch not extending to middle segment	4.
4.	18 to 26 testes	*C. barbara*, p. 161.
	35 to 45 testes	? *C. galbula*, p. 162.

(1) Choanotænia infundibuliformis (Goeze, 1782) Railliet, 1896. (Fig. 315.)

Synonymy extensive, but including the following:—
Tænia infundibuliformis Goeze, 1782.
Tænia cuneata Batsch, 1786
Drepanidotænia infundibuliformis Goeze, 1782.
Choanotænia infundibulum (Bloch, 1782) Cohn, 1899.
Monopylidium infundibuliformis (Goeze, 1782) Clerc, 1903.

From the domestic fowl; Rangoon. Meggitt.

The worm attains a length of from 5 to 20 cm. and a maximum breadth of 1·5 mm. The posterior segments are almost square. The genital pores are irregularly alternate and are situated in the anterior third of the lateral margin of the segment. The scolex has a diameter of from 60 to 70 μ and bears from 20 to 22 hooks, each measuring from 20 to 30 μ in length.

There are from 20 to 30 testes situated in the median field posteriorly to the ovary. The cirrus sac is small, not extending to the longitudinal excretory vessels. The cirrus is long and armed with spines.

The ovary is bilobed, the aporal lobe being larger than the poral. According to Fuhrmann (1926) and Joyeux (1923), the uterus is unstable and breaks up into egg-capsules, each usually containing a single egg. If this is the case, then the species cannot be placed in the subfamily Dilepidinæ.

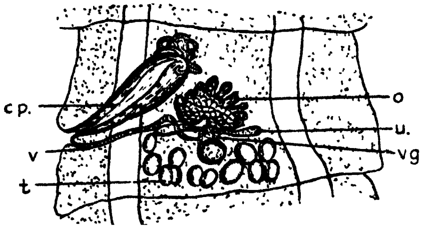


Fig. 315.—*Choanotænia infundibuliformis.* Mature segment, × 53. (After Meggitt.)

Meggitt (1926), however, states that the eggs are not in capsules, but the uterus becomes divided up into small cavities by the ingrowth of septa from the uterine wall, the cavities being in communication with each other. The egg is oval and measures from 32 to 40 μ by 36 to 50 μ. The oncosphere measures 32 by 22 μ and the hooks in the egg 18 μ.

Intermediate hosts :—The dung-beetle (*Geotrupes sylvaticus*) and the house-fly (*Musca domestica*).

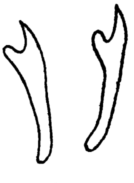


Fig. 316.—*Choanotænia decacantha.* Rostellar hooks, magnification unknown. (After Fuhrmann.)

(2) Choanotænia decacantha Fuhrmann, 1913. (Fig. 316.)

From a snipe (*Capella* sp.); Berhampur, Bengal. Southwell.

The worm attains a length of about 6 mm. and a breadth of 500 μ. It consists of from 40 to 50 segments, the last ones being longer than broad; the genital pores are regularly alternate and are situated in the anterior part of the lateral margin of the segment. The scolex has a breadth of 2 mm.

The rostellum is armed with a single crown of 10 hooks, each having a length of 20 or 21 μ.

There are from 13 to 16 testes. The cirrus sac has a length of about 100 μ.

The ovary is large, bilobed, and has a breadth of 160 μ. Immediately posterior to it is the vitelline gland, which has a diameter of 50 μ. The receptaculum seminis is prominent. The egg measures about 24 μ and appears to be isolated in the parenchyma in fully gravid segments.

(3) **Choanotænia barbara** Meggitt, 1926. (Fig. 317.)

Synonym :—*Choanotænia innominata* Meggitt, 1926.

From (1) *Passer montanus*; Rangoon. Meggitt. (2) a finch, genus and species unknown; Rangoon. Meggitt.

The worm varies in length from 2 to 3 cm. and has a maximum breadth of 850 μ. The genital pores are situated almost at the anterior corner of the margin of the proglottis. The scolex has a diameter of 20 μ; the rostellum, which measures 10 μ in diameter, is armed with 23 hooks, each having a length of from 15 to 17 μ.

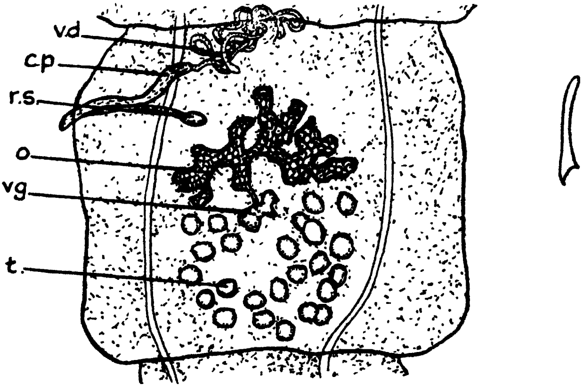


Fig. 317.—*Choanotænia barbara.* Rostellar hook, × 900; mature segment, × 80. (After Meggitt, in 'Parasitology.')

Male Genitalia. There are from 18 to 26 testes situated posteriorly to the ovary; the cirrus sac attains a maximum length of 190 μ and extends internally to the longitudinal excretory vessels.

Female Genitalia. The ovary is much lobed; the vitelline gland is situated slightly on the poral side and faces towards the genital pore. The uterus is sac-like; in gravid segments it extends to the excretory vessels, and its wall becomes a little indistinct.

(4) ? Choanotænia galbulæ (Zeder, 1803) Cohn, 1899. (Fig. 318.)

Synonym:—*Tænia galbulæ* Zeder, 1803; var. of *Tænia serpentiformis* Goeze, 1782.

Meggitt records what he believes to be this species from a crow (*Corvus splendens insolens*); Rangoon. Meggitt.

The worm measured 1·7 cm. in length and had a breadth of 400 μ. The proglottides were immature; the genital pore alternates, and is situated at the limit of the anterior quarter of the margin of the proglottides. The scolex measures from 250 to 350 μ in diameter. The rostellum has a diameter of 100 μ and extends to, or beyond, the posterior margin of the suckers. It is armed with 21 hooks; Meggitt gives their length as from "0·36 to 0·04 mm." (*sic* 0·036 ?). The testes appear to number from 35 to 45.

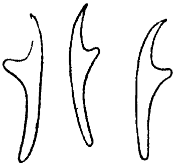


Fig. 318.—*Choanotænia galbula.* Rostellar hooks, × 500. (After Meggitt.)

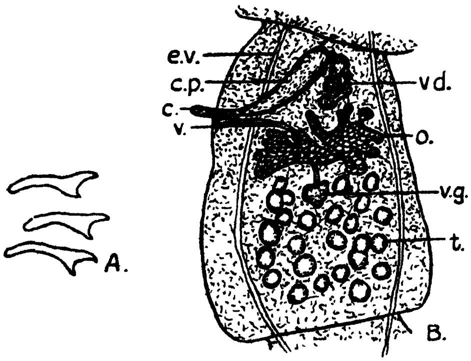


Fig. 319.—*Choanotænia magnicirrosa.* A, rostellar hooks, × 666; B, mature segment, × 53. (After Meggitt, in 'Parasitology.')

(5) Choanotænia magnicirrosa Meggitt, 1926. (Fig. 319.)

From *Acridotheres tristis*; Rangoon. Meggitt.

The worm attains a length of 1·5 cm. and a breadth of 600 μ. The genital pores are situated in the anterior third of the margin of the proglottis. The scolex has a diameter of from 250 to 300 μ and the rostellum of from 80 to 90 μ The latter organ extends beyond the anterior, but not beyond the posterior margin of the suckers ; it is armed with a single circle of from 22 to 24 hooks, each having a length of 18 to 19 μ.

Male Genitalia. There are 27 testes situated posteriorly to the ovary, larger and more closely aggregated than in *C. barbara*. The cirrus sac attains a maximum length of from 250 to 350 μ and extends obliquely to the middle of the anterior margin of the segment.

Female Genitalia. The ovary is situated slightly on the pore side and is bilobed, there being a long isthmus joining the two wings ; each part is subdivided laterally, the aporal half being larger than the poral. Gravid proglottides unknown.

(6) **Choanotænia** sp. Southwell, 1922.

From *Totanus hypoleucos*; Barkuda Island, Chilka Lake, Orissa. Southwell.

A number of specimens, all without heads, apparently belonging to the above genus, have been recorded, but their specific identity is quite uncertain.

Genus IV. **ANOMOTÆNIA** Cohn, 1900.

Synonym :—*Diplochetos* Linstow, 1906.

Rostellum armed with a double crown of hooks, with long dorsal and short ventral root and long blade. Genital pores irregularly alternate. Genital canals pass between longitudinal excretory vessels. Testes numerous, posterior, or also lateral to the female glands. Uterus sac-like. Adults in birds and mammals.

Type-species :—*Anomotœnia microrhyncha* (Krabbe, 1869).

(1) **Anomotænia volvulus** (Linstow, 1906) Fuhrmann, 1908. (Fig. 320.)

Synonym :—*Diplochetos volvulus* Linstow, 1906.

From the yellow-wattled lapwing (*Lobipluvia malabarica*). Weligatta, Ceylon. ? Willey.

The worm attains a length of about 8·5 mm. and a maximum breadth of about 700 μ. All the segments are broader than long. The genital pores are irregularly alternate and are situated near the anterior extremity of the lateral margin of the segment. The scolex measures 260 μ in length by 350 μ in breadth. The rostellum is armed with 24 hooks, each having a length of 47 μ and arranged in a double row. The muscular system is well developed, the longitudinal fibres being in three layers of bundles, the largest one being internal.

The testes are numerous and are situated behind and laterally to the ovary. The cirrus sac extends one-fifth the distance across the segment and contains coils of the vas deferens. Median to the sac the vas deferens is also coiled. The ovary is bilobed, each half consisting of a number of follicles. The vagina is situated ventrally to the cirrus sac, and the genital ducts pass between the longitudinal excretory vessels and dorsally to the nerve. Near the middle of the segment the vagina dilates into a large receptaculum seminis. The uterus is a large irregularly-shaped sac. Linstow stated that the egg measures 16 by 13 μ.

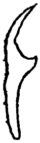


Fig. 320.—*Anomotænia volvulus.* Rostellar hook, magnification unknown. (After Linstow.)

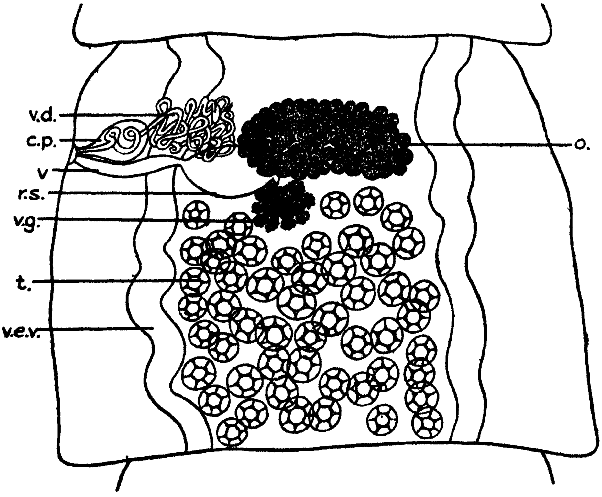


Fig. 321.—*Anomotænia acollis.* Mature segment, × 90. (Original.)

(2) **Anomotænia acollis** Fuhrmann, 1907. (Fig. 321.)

From *Cuculus varius*; Zoological Gardens, Calcutta. Southwell.

The worm attains a length of 4 cm. and a maximum breadth of 1 mm. The posterior segments measure at least 1·4 mm. in length and have a breadth of 900 μ. The genital pores are irregularly alternate and are situated in the anterior fifth of the lateral margin of the segment. The head is cubical, attaining a breadth of 300 μ. The rostellum bears about 40 hooks arranged in a double row ; the hooks in one row measure 50 μ and in the other 46 μ.

The testes are numerous and are situated behind the ovary ; they occupy two-thirds the length of the segment between the excretory vessels. The cirrus sac is small, almost spherical, and has a diameter of 65 μ ; it does not extend to the water vessel. The vas deferens is notably conspicuous as a densely coiled, darkly staining mass immediately median and slightly anterior to the cirrus sac ; the coils lie on each side of the water vessel.

The ovary is situated anteriorly, just behind and median to the vas deferens. It is bilobed and glandular in appearance ; posterior to it is a conspicuous vitelline gland. The vagina is situated posteriorly to the cirrus sac. Internal to the excretory vessel it at once dilates into an enormous receptaculum seminis having a length of 84 μ and a breadth of 63 μ. The eggs fill the entire segment and extend laterally to the excretory vessels ; no trace of a uterine wall could be found.

(3) **Anomotænia ? constricta** (Molin, 1858) Cohn, 1903.

From a crow. Punjab Civil Veterinary Department. Southwell.

One specimen, without a head, almost certainly belonging to the genus *Anomotænia*, has been obtained from this host. It is impossible, in the absence of a head, to state definitely to which species it belongs, but in its anatomical details it agrees with *A. constricta* (Molin, 1858).

Genus V. AMŒBOTÆNIA Cohn, 1890.

Rostellum armed with a single crown of hooks. Segments less than 30, broader than long. Genital pores regularly alternate. Testes rather numerous (12 or more), posterior. Uterus sac-like. Adults in birds.

Type-species :—*Amœbotænia sphenoides* (Railliet, 1892).

Amœbotænia sphenoides Railliet, 1892. (Fig. 322.)

Synonyms :—*Tænia cuneata* Linstow, 1872.
Tænia sphenoides Railliet, 1892.
Dicranotænia cuneata Railliet. 1893.
Dicranotænia sphenoides Railliet, 1896.
Amœbotænia cuneata Cohn, 1900.

From (1) The domestic fowl ; Berhampur, Bengal. Southwell. Burma. Meggitt. (2) *Gallus ferrugineus* ; Victoria Memorial Park, Rangoon. Meggitt.

The young worm is characteristically wedge-shaped, but this shape is lost as it becomes gravid. They have a maximum length of about 2 mm. and the number of segments varies from 13 to 24. In a surface view the segment is much broader than long. The parenchyma is continuous throughout the strobila. In gravid segments the result is that ripe eggs from one segment may intrude into the adjacent segment, that is, in the posterior part of the strobila the segments are hardly separated from each other internally. The head is almost square and has a length of about 200 μ; it is provided with four suckers and a well-developed protrusible rostellum. The latter has a length of about 150 μ and a breadth of 40 μ. It bears from 12 to 14 hooks, each measuring about 25 μ in length and having a shape characteristic of the species. The dorsal root is short and of the same length as the ventral root, with a comparatively long sinuous blade. The genital pores are regularly alternate and are situated close to the anterior corner of the segment.

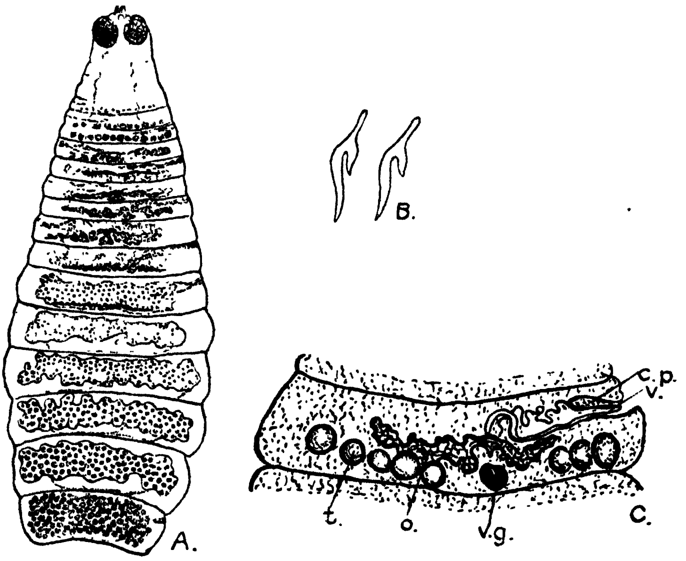


Fig. 322.—*Amœbotænia sphenoides.* A, entire worm; B, rostellar hook, magnification unknown. (After Monnig.) C, mature segment, × 68. (After Meggitt.)

Musculature. As the worm is small, this system is naturally delicate. Beneath the cuticle is a single layer of longitudinal cuticular muscle fibres. Under the subcuticula there is a well developed system of longitudinal muscles consisting of a number of distinct bundles. Circular muscles are apparently absent.

Male Genitalia. The rudiments of the male genital organs appear in the second segment. There are 12 testes, each having a diameter of 45 μ, and they lie in a single row on the dorsal surface at the posterior end of the proglottis. The vas deferens arises near the centre of the proglottis and runs to the anterior border, where it bends at right angles and becomes much coiled before it enters the cirrus sac. A vesicula seminalis is absent. The cirrus sac is cylindrical and bends upon itself.

Female Genitalia. Female genital organs develop in about the fourth segment and persist to about the 14th. The ovary is placed a little on one side of the median line in the middle of the segment. At first it is butterfly-shaped. The vitelline gland lies behind and between the two wings of the ovary. The shell gland is situated posteriorly to the vitelline gland. The vagina runs behind the cirrus sac, its opening being surrounded by a sphincter muscle. It bends sharply forwards, then runs horizontally beyond the extremity of the cirrus sac, where it opens into a pear-shaped receptaculum seminis. The uterus is at first a simple transverse sac appearing in the 12th segment. When fully developed it overlaps the excretory vessels and develops a number of finger-like outgrowths which later fuse. The egg measures about 30 μ.

Grassi and Rovelli state that in Lombardy the larval form of this worm occurs in the earthworm *Allolobophora fœtida.* Meggitt (1926) records the larval form in Burma from *Allolobophora fœtida*, *Pheretima peguana*, and *Pheretima* sp.

Genus VI. **PARVIROSTRUM** Fuhrmann, 1907.

Synonym :—*Taufikia* Woodland, 1928.

Fuhrmann described this genus as follows :—

Strobila small, division into segments not well marked. Scolex large, rostellum small, armed with a double crown of hooks. Genital pores irregularly alternate. Reproductive glands very small. Testes in lateral portions of segment. Ovary and yolk gland towards pore side of segment. Uterus sac-like. Adults in birds.

Type-species :—*Parvirostrum reticulatum* Fuhrmann, 1908.

Up to the present only one species, viz., the type-species, of this genus has been described ; a second species has now been obtained from an Indian vulture, species not known.

As the worm from India clearly falls within the genus, but exhibits new characters, it is necessary to re-define the genus *Parvirostrum* as follows :—

Medium to large worms ; division into segments not well marked. Scolex large ; rostellum small, armed with a double crown of hooks. Genital pores irregularly alternate ; reproductive glands very small ; testes principally in two lateral groups, one group on each side, but a few testes may occur both anteriorly and posteriorly to the female genital organs. Ovary and vitelline gland slightly on the pore side of the segment. Uterus a narrow transverse tube expanding laterally in a number of small digitiform processes. Adults in birds.

Type-species :—*Parvirostrum reticulum* Fuhrmann, 1908.

The arrangement of the genital organs in this genus resembles closely that of the genus *Aporina* Fuhrmann, 1902. In the latter genus, however, the head is unarmed and the genital pores are apparently absent.

Parvirostrum magnisomum, sp. n. (Figs. 323 & 324.)

From a vulture. Civil Veterinary Department, Lahore.

Two specimens were obtained, neither of which possessed a head. The total length of each worm is about 25 cm. and the maximum breadth about 7 mm. They have a thickness of about 2 mm. Segmentation is indistinct even under low magnification. The cuticle of the worm is rugose and has a thickness of 6 μ. All the segments are broader than long ; the most posterior ones have a length of 1·7 mm. and a breadth of 4 mm. The genital pores are irregularly alternate and are situated at the junction of the anterior and middle thirds of the lateral margins of the segment.

Musculature. The longitudinal muscles consist of numerous bundles arranged in a single layer, the largest ones being internal. A layer of circular fibres lies immediately internal to the longitudinal bundles.

Excretory System. The excretory system consists of a ventral vessel only on each side, and the genital ducts pass dorsally to it. The vessels communicate with each other by a prominent transverse duct in the posterior part of each segment ; they vary in width within wide limits and are often dilated into large globular vesicles.

A single longitudinal nerve runs throughout the length of the worm laterally to the ventral excretory vessel.

Male Genitalia. The testes vary in number from about 70 to 110 in each segment ; they are in two groups, one on each side of the segment, the greater number being situated aporally. In some segments a number of testes also occur anteriorly or posteriorly to the ovary, or both. The cirrus sac

Fig. 323.

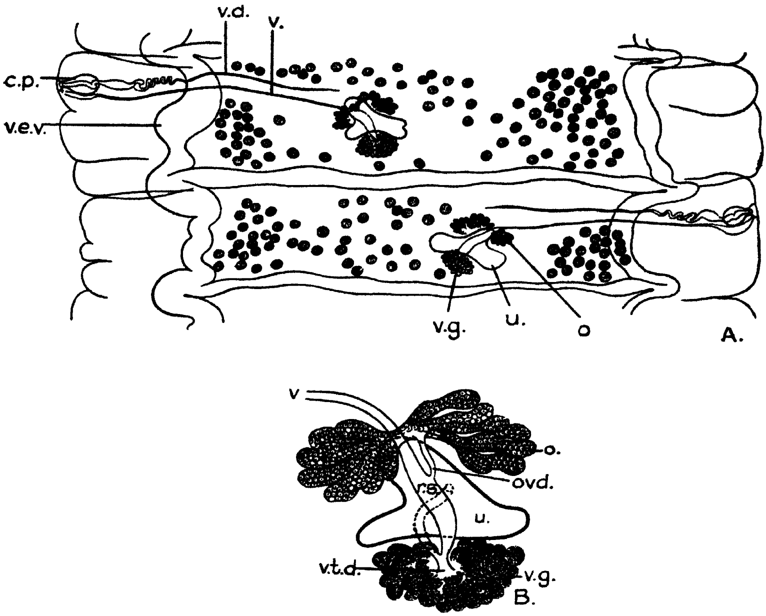
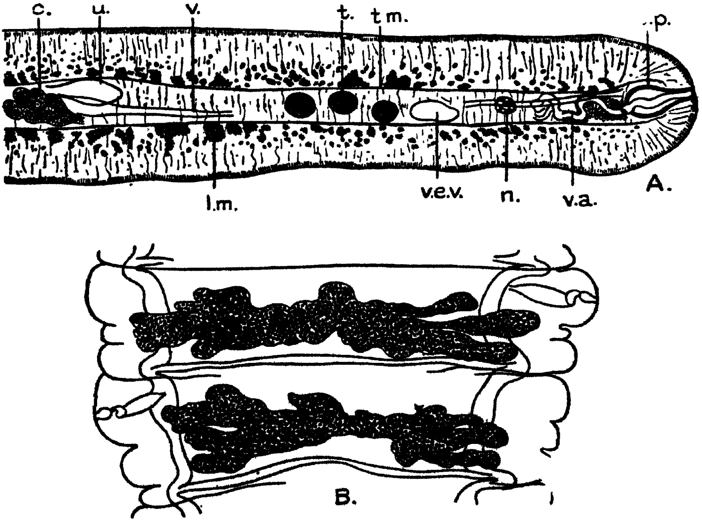


Fig. 324.



Parvirostrum magnisomum, sp. n.

Fig. 323.—A, mature segments, × 27; B, enlarged view of genital ducts, × 90.
Fig. 324.—A, transverse section showing musculature, × 53; B, gravid segments, × 12.

is very small and flask-shaped, extending only one-third the distance from the lateral margin to the excretory vessels. It has a length of 168 μ and a breadth of 105 μ; the cirrus is unarmed. The vas deferens dilates into a seminal vesicle immediately median to the cirrus sac, the dilated portion being surrounded by glandular cells. Between the seminal vesicle and the excretory vessels the vas deferens is much coiled; median to the excretory vessels it pursues an almost straight course and gradually disappears.

Female Genitalia. The ovary is bilobed and situated in the poral half of the segment in the median transverse axis; posteriorly to it is a prominent vitelline gland. The vagina runs posteriorly to the cirrus sac, its terminal portion being dilated. It follows a slightly curved course to the mid-ovarian region, where it dilates into a prominent receptaculum seminis. The uterus arises as a Y-shaped outgrowth immediately dorsal to the ovary, gradually extending as a transverse tube, the lateral extremities of which eventually become digitate.

Genus VII. GRYPORHYNCHUS Nordmann, 1832.

Synonym :—*Acanthocirrus* Fuhrmann, 1907.

Rostellum armed with a double row of hooks. Genital pores unilateral. Genital canals pass between longitudinal excretory vessels. Root of cirrus with one or two pairs of powerful spines lying in special pockets. Testes few (6 to 8), posterior. Uterus sac-like. Adults in birds.

Type-species :—*Gryporhynchus pusillus* Nordmann, 1832.

Gryporhynchus pusillus Nordmann, 1832.

Synonyms :—*Tænia macropeos* Wedl, 1855.
Dilepsis macropeos (Wedl, 1855) Clerc, 1906.
Acanthocirrus macropeos (Wedl, 1855) Fuhrmann, 1907.

From a pond-heron (*Ardeola grayi*); Zoological Gardens, Calcutta. Southwell.

The worms are very small and attain a maximum length of about 5 mm. and a breadth of 300 μ. They consist of about 30 segments which are square. The genital pores are unilateral and situated in the anterior quarter of the lateral margin of the segment. The scolex has a breadth of 160 μ and is armed with about 20 hooks, arranged in a double row; the large hooks measure 40 μ in length and the small ones 23 μ.

There are from six to eight testes in each segment. The cirrus sac extends two-thirds the distance across the segment; the cirrus has a length of 130 μ and a breadth of 18 μ; it is covered with extremely minute spinules, and at its base it bears powerful spines. The uterus is sac-like and appears to consist of two circular cavities, one on each side, which communicate with each other.

Genus VIII. PENTORCHIS Meggitt, 1927.

Rostellum unarmed (?). Genital pores unilateral. Testes few, along posterior margin of segment, some external to excretory vessels. External vesicula seminalis absent. Receptaculum seminis large. Uterus sac-like. Adults in mammals.

Type-species :—*Pentorchis arkteios* (corr. *arctius*) Meggitt, 1927.

Pentorchis arctius Meggitt, 1927. (Fig. 325.)

From *Ursus malayanus* ; Victoria Memorial Park, Rangoon. Meggitt.

The worm attains a length of 14 cm. and a breadth of 1 mm. ; it is made up of numerous segments all of which are broader than long. The genital pores are unilateral and are situated slightly behind the middle of the lateral margin of the segment ; there is a small genital atrium, the mouth of which is surrounded by a definite sphincter muscle. The scolex has a diameter of 380 μ and the rostellum one of 70 μ. The latter extends posteriorly just beyond the middle of the suckers. Meggitt was unable to discover any hooks, but points out that these might have been lost. Details of the musculature are not known.

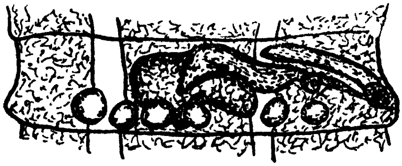


Fig. 325.—*Pentorchis arctius.* Mature segment, × 70. (After Meggitt, in 'Parasitology.')

Male Genitalia. There are five testes, situated along the posterior margin of the segment ; three of these being usually aporal and two poral. The cirrus sac measures from 250 to 350 μ by 30 to 40 μ, and extends in the median direction to the centre of the segment.

Female Genitalia. The ovary is sac-shaped and situated in the middle of the segment. The vagina opens posteriorly to the cirrus sac ; it is much coiled and, just median to the excretory vessel, it dilates into a large receptaculum seminis, which extends almost to the ovary. Both the coils of the vagina and the receptaculum seminis may extend anteriorly to the cirrus sac. The uterus is a slightly lobulated, persistent sac, divided up by a few very small incomplete septa, and when fully gravid it extends to the margin of the segment.

Meggitt remarks that this species falls either in the Dilepidinæ or Hymenolepidinæ, thus :—" From the latter it differs in the absence of an external vesicula seminalis and in the course of the genital ducts, but agrees with it in the unilateral genital pores, the small number of testes and the short broad proglottides ; it differs from the former in the last two characters, but agrees in all else. The present form is thus intermediate between the two, but has greater affinities with the former ; the diagnosis of that subfamily must therefore be altered to 'Testes numerous or few (5)' .... ; the present form falls into line with *Dendrouterina*, *Clelandia* and *Cyclorchida*. From the first it is separated by the absence of a uterine reticulum, from the second by the arrangement of the testes and the absence of powerful cirrus spines, from the third by the absence of a genital papilla and vesicula seminalis and the position of the testes, and from all three by the small number of testes and the (?) unarmed rostellum."

Genus IX. **DELTOCERAS** Meggitt, 1927.

Rostellum armed with triangular hooks ; genital pores unilateral. Testes numerous, posterior and lateral to the female glands. Uterus persistent.

Type-species :—*Deltokeras ornitheios* (corr. *Deltoceras ornithium*) Meggitt, 1927.

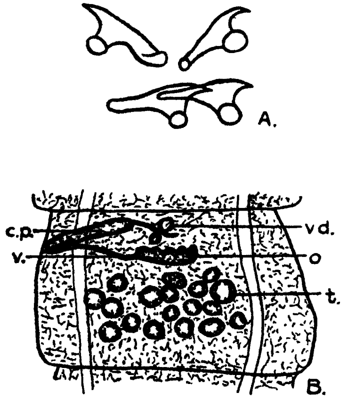


Fig. 326.—*Deltoceras ornithium.* A, rostellar hooks, × 530 ; B, mature segment, × 47. (After Meggitt, in 'Parasitology.')

Deltoceras ornithium Meggitt, 1927. (Fig. 326.)

From *Urocissa occipitalis* ; Victoria Memorial Park, Rangoon. Meggitt.

The worm attains a length of 4 cm. and a maximum breadth of about 1·1 mm. The genital pores are unilateral and are situated at the anterior third of the lateral margin of the segment ; the genital atrium is either small or absent. The rostellum is armed with 40 hooks in two rows. Each hook measures from 27 to 31 μ in length and the hooks in both rows are alike.

Male Genitalia. There are 20 testes situated posteriorly and laterally to the ovary. The cirrus sac measures from 140 to 200 μ by 40 μ, and extends median to the excretory vessels.

Female Genitalia. The ovary is sac-shaped, slightly lobed and ventrally placed. Fully gravid segments have not been described; the ripe segments contain a lobed sac (the uterus) full of eggs, which occupies the position formerly occupied by the ovary and extends to the anterior margin of the segment. There is no indication of even the beginning of a paruterine organ, but if one appears later on it must develop posteriorly.

Genus X. **CYCLORCHIDA** Fuhrmann, 1907.

Rostellum armed with a double crown of hooks, each hook having a large dorsal root and a small blade. Genital pores unilateral. Genital canals pass between the longitudinal vessels. Cirrus sac communicating with genital atrium by a narrow canal opening upon a large papilla. Testes very numerous, entirely surrounding the female glands. Uterus ventral, growing laterally between the excretory vessels into the cortical parenchyma. Adults in birds and mammals.

Type-species:—*Cyclorchida omalancristrota* (Wedl, 1856).

Cyclorchida omalancristrota (Wedl, 1856) Fuhrmann, 1907. (Figs. 327 & 328.)

Synonym:—*Tænia omalancristrota* Wedl, 1856.

From a spoon-bill (*Platalea* sp.); Zoological Gardens, Calcutta. Southwell.

The worm attains a length of 25 cm. and a breadth of 4 mm. The segments are all broader than long, and their lateral margins are slightly salient. The genital pores are unilateral, each one being situated on a papilla in the anterior half of the lateral margin of the segment; the pore opens into a rather long narrow genital atrium. The head is large and rounded, having a breadth of about 400 μ, with powerful suckers which have a diameter of about 180 μ. The short stout rostellum is armed with 20 peculiarly shaped hooks arranged in a double row. The hooks in the anterior row have a length of 170 μ, and those in the posterior are about 60 μ.

The longitudinal muscles consist of two layers of bundles, the inner one being much larger than the outer. Internal to the longitudinal muscles there is a well developed circular layer of fibres.

The excretory system consists of two vessels on each side, a large ventral vessel and a small dorsal one, lateral to which is a minute longitudinal nerve.

The testes are very numerous (about 90), and entirely surround the female genitalia. The vas deferens is very coiled and, together with the vagina, passes between the longitudinal excretory vessels. The cirrus sac is very long, viz., about 200 μ, and extends median to the longitudinal excretory vessels; it is almost a third the breadth of the segment.

Fig. 327.

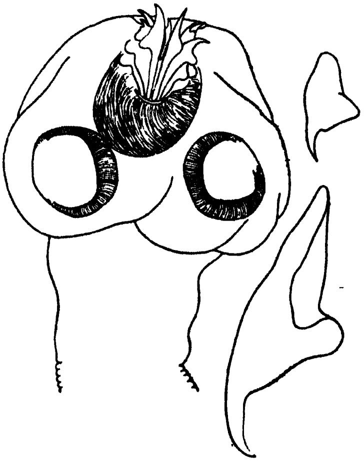
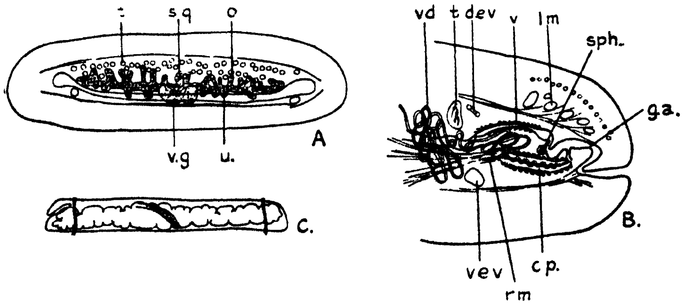


Fig. 328.



Cyclorchida omalancristrota.

Fig. 327.—Head, × 53, and rostellar hooks, × 200. (Original.)
Fig. 328.—A, transverse section of mature segment; B, transverse section of poral half of segment, showing arrangement of genital ducts; C. gravid segment. Magnification unknown. (After Fuhrmann.

The ovary is large, broad,' short antero-posteriorly, and bilobed; it has a breadth of about 570 μ and occupies the middle half of the segment; each lobe consists of a number of short tubes extending dorsally and ventrally. The vagina runs posteriorly to the cirrus sac and the walls of its terminal part are glandular. It dilates into a long fusiform receptaculum seminis. The vitelline gland is large, reniform, and situated posteriorly to the ovary; a small yolk reservoir lies in its concavity, whilst antero-dorsally to it is the small shell gland. The uterus is at first a narrow transverse tube which eventually widens and extends between, and lateral to, the excretory vessels: when fully gravid it entirely fills the segment, and its cavity is divided up into compartments by ingrowths from its wall. The oncosphere measures 24 μ.

Subfamily II. DIPYLIDIINÆ Stiles, 1896.

Rostellum armed (except in *Eugonodæum*). Suckers unarmed. A single or double set of reproductive organs in each segment. Uterus sac-like, reticulated, simple or lobed, breaking down into numerous egg-capsules, each containing one or several eggs. Paruterine organs absent. Adults in birds, mammals, and fishes.

Type-genus :—*Dipylidium* Leuckart, 1863.

Key to Genera.

1.	Genitalia single	2.
	Genitalia double	DIPYLIDIUM, p. 175.
2.	Rostellum armed with a single row of hooks..........................	3.
	Rostellum armed with a double row of hooks..........................	4.
3.	Genital pores unilateral	MALIKA, p. 183.
	Genital pores irregularly alternate	PROCHOANOTÆNIA, p. 181.
4.	Genital pores unilateral	SOUTHWELLIA, p. 180.
	Genital pores irregularly alternate	MONOPYLIDIUM, p. 178.

Genus I. DIPYLIDIUM Leuckart, 1863.

Synonym :—*Cryptocystis* Villot, 1882.

Rostellum armed with several circlets of hooks which are usually rose-thorn-shaped and provided with a discoidal base. A double set of reproductive organs in each segment. Testes numerous, scattered throughout the entire medullary parenchyma. Uterus at first reticulate, later breaking up into egg-capsules, each containing one or more eggs. Adults in birds and mammals, larval stages in insects and reptiles.

Type-species :—*Dipylidium caninum* (Linnæus, 1758).

Key to Species.

1.	Egg-capsules each contain many eggs....	2.
	Egg-capsules each contain one egg	*D. gervaisi*, p. 177.
2.	Rostellum armed with from two to five rows of hooks; eggs 50 μ	*D. caninum*, p. 176.
	Rostellum armed with six or seven rows of hooks; eggs 25 μ..................	*D. sexcoronatum*, p. 178.

(1) **Dipylidium caninum** (Linnæus, 1758). (Fig. 329.)

Synonymy extensive, including:—

Dipylidium oerleyi Ratz, 1900.
Dipylidium walkeri Sondhi, 1925.

From (1) Cats; Punjab. Civil Veterinary College, Lahore. Southwell. (2) Dogs; Indian Museum and Ceylon. Southwell. (3) Dogs; Lahore and Punjab. Gaiger. (4) Dogs; Lahore and Punjab. Sondhi. (5) Dogs; Rangoon. Meggitt. (6) *Felis viverrina*; Zoological Gardens, Calcutta. Southwell. (7) *Hyæna striata*; Zoological Gardens, Calcutta. Southwell. (8) The Himalayan palm-civet (*Paradoxurus grayi*); Zoological Gardens, Calcutta. Southwell.

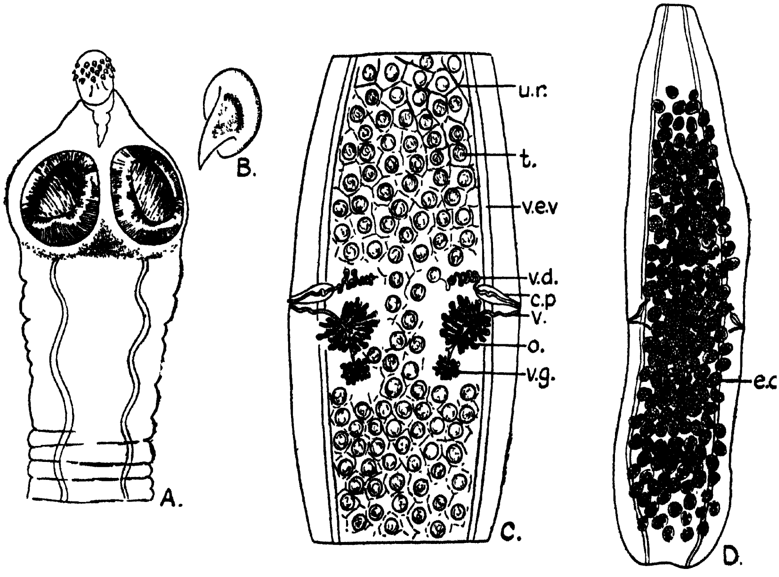


Fig. 329.—*Dipylidium caninum.* A, head, × 75; B, rostellar hook, × 770; C, mature segment, × 23; D, gravid segment, × 11. (Original.)

The worm lives normally in the intestine of dogs and cats. It occurs infrequently in man. The larval stage is a cysticercoid and is found in the dog-louse (*Trichodectes canis*), the dog-flea (*Ctenocephalus canis*), the cat-flea (*Ctenocephalus felis*), and in the flea of man (*Pulex irritans*).

The adult worms vary in size up to a maximum length of about 40 cm. and a maximum breadth of 3 mm. Mature segments are longer than broad (7 mm. by 2 to 3 mm.) and each segment has two genital pores, one on each lateral margin.

The head is very small and has a club-shaped rostellum armed with from two to five rings of very small rose-thorn-shaped hooks. Those in the anterior ring are the largest (11 to 15 μ), whilst those in the posterior ring are smaller (6 μ).

Each segment contains a double set of genital organs, one on each side. Another peculiar feature of the anatomy of this worm is the fact that the testes lie in a reticulum, one testis in each reticular space. As the testes disappear after functioning, each space, previously occupied by a testis, comes to contain a capsule in which there are from 5 to 20 eggs—that is to say, the uterus is reticular and the eggs are in capsules. The egg measures about 50 μ in diameter and is remarkably similar to the egg of *Hymenolepis nana* and *Hymenolepis diminuta.* The oncosphere measures from 25 to 36 μ in diameter. In this respect it differs from the egg of *H. nana,* in which the oncosphere only measures about 18 μ. The oncosphere of *H. diminuta* is about the same size as that of *Dipylidium caninum,* but in *H. diminuta* the egg-shell is thick, whilst in *D. caninum* it is thin.

The eggs, when swallowed by, say, the larvæ of the dog louse, or flea, etc., develop into cysticercoids which during the metamorphosis of these larvæ eventually come to lie in the body-cavity of the adult flea or louse. They are transferred to the dog's mouth and swallowed as a result of its biting or licking these external parasites. In the dog's alimentary canal the cysticercoid develops into the adult worm.

It is doubtful whether the following species can be differentiated from *D. caninum,* viz. :—*D. walkeri* Sondhi, 1925 ; *D. crassum* Millzner, 1926 ; *D. compactum* Millzner, 1926 ; *D. gracile* Millzner, 1926 ; *D. longulum* Millzner, 1926 ; *D. diffusum* Millzner, 1926 ; *D. œrleyi* Ratz, 1900 ; *D. quinquecoronatum* Lopez-Neyra and Medina, 1921.

(2) **Dipylidium gervaisi** Setti, 1895.

From (1) *Felis viverrina* ; Zoological Gardens, Calcutta. Southwell. (2) The Malayan palm-civet (*Paradoxurus hermaphroditicus*) ; Zoological Gardens, Calcutta. Southwell.

The worm measures from 1 to 4 cm. in length and has a maximum breadth of 1 mm. The scolex is not sharply divided from the neck ; from the rostellum to the posterior margin of the suckers it measures 150 μ and its maximum breadth is 250 μ ; the rostellum is small and bears from eight to twelve rows of hooks. The excretory vessels are large. The egg-capsules contain each a single egg.

(3) Dipylidium sexcoronatum Ratz, 1900.

From dogs; Punjab. Sondhi.

The worm measures up to 30 cm. in length and has a maximum breadth of 2 mm. The scolex has a diameter of from 340 to 380 μ and a breadth of from 240 to 380 μ. The rostellum has a length of 65 μ and a breadth of 115 μ; it is armed with six, occasionally seven, rows of hooks. The egg-capsules sometimes extend laterally to the excretory vessels, each capsule containing from 2 to 15 eggs. The egg has a diameter of 25 μ.

Dipylidium sp. Gaiger (1915) records a worm from a dog, Lahore, which he doubtfully refers to the above genus.

Genus II. MONOPYLIDIUM Fuhrmann, 1899.

Rostellum with a double crown of hooks. Genital ducts pass between, or dorsally to, the longitudinal excretory vessels. A single set of reproductive organs in each segment. Testes numerous, posterior. Uterus much branched, breaking down into egg-capsules which usually contain each a single egg. Adults in birds.

Type-species:—*Monopylidium musculosum* (Fuhrmann, 1896).

The following table shows the close relationship between the genera detailed below. It will be noted that the genus *Choanotænia* Railliet, 1896, has a persistent uterus, whilst in the remaining three genera the uterus breaks up into egg-capsules. The former genus is accordingly placed in the subfamily Dilepidinæ Fuhrmann, 1907, whilst the latter three genera are included in the Dipylidiinæ Stiles, 1896. Attention has been called elsewhere to the fact that the three genera *Amœbotænia* Cohn, 1899; *Anomotænia* Cohn, 1900; and *Choanotænia* Railliet, 1896, are very closely related (see page 159):—

	Choanotænia Railliet, 1896.	*Monopylidium* Fuhrmann, 1899.	*Prochoanotænia* Meggitt, 1924 = *Choanotænia* Luhe, 1910.	*Southwellia* Moghe, 1925.
Rows of hooks on rostellum.	Single.	Double.	Single.	Double.
Genital pores.	Irregularly alternate.	Irregularly alternate.	Irregularly alternate.	Unilateral.
Uterus ...	Persistent.	Resolves into capsules, one egg in each.	Resolves into capsules, one egg in each.	Resolves into capsules, 5 to 9 eggs in each.

Monopylidium chandleri Moghe, 1925. (Fig. 330.)

From *Sarcogrammus indicus*; Nagpur, Central Provinces. Moghe.

The worm attains a length of 7 cm. and a maximum breadth of 3·3 mm. ; it is composed of about 135 segments, all of which are broader than long. The genital pores are irregularly alternate and are situated a little anterior to the middle of the lateral margin of the segment. The neck measures from 2 to 2·5 mm. in length. The scolex, which is not distinctly set off from the neck, has a diameter of 920 μ. The rostellum is large, muscular, and conical, terminating in a rounded knob; it measures about 517 μ in length and has a maximum breadth of about 320 μ. It is armed with 20 hooks, which alternate with each other, but whether they are in a single row or a double row is largely a matter of opinion. All the hooks are of the same size and shape and measure about 117 μ in length.

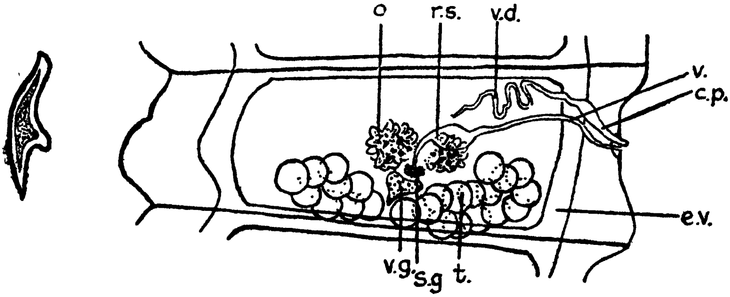


Fig. 330.—*Monopylidium chandleri.* Rostellar hook, × 160; mature segment, × 45. (After Moghe, in 'Parasitology.')

Male Genitalia. There are from 20 to 24 testes situated posterior to the ovary, except a few on the poral side which are lateral to it. The vas deferens is a loosely coiled tube situated anteriorly. The cirrus sac measures about 176 μ in length.

Female Genitalia. The ovary is situated centrally and is bilobed. The vitelline gland is small and placed immediately behind the middle of the ovary. The shell gland is a small organ between the vitelline gland and the ovary. The vagina is a straight tube situated posteriorly to the vas deferens; near the poral ovarian lobe it dilates into an oval receptaculum seminis which measures about 117 by 75 μ. The uterus splits up into egg-capsules, each segment containing from 140 to 165. Each capsule contains a single spherical egg having a diameter of 82 μ. The oncosphere measures 48 μ.

Moghe (1925) proposed the new subgenus ***Macracanthus*** to accommodate three species of ***Monopylidium***, viz., ***M. stercorarium*** Baylis, 1919 ; ***M. macracanthum*** Fuhrmann, 1908 ;

and *M. chandleri* Moghe, 1925, in all of which the head bears a small number of very large hooks, whilst in the remaining species of the genus the hooks are more numerous and smaller. The erection of this subgenus, depending, as it does, merely on the size of hooks, appears wholly unjustifiable.

Genus III. **SOUTHWELLIA** Moghe, 1925.

Synonym :—*Monopylidium* Southwell, 1921.

Hooks very numerous (120) and of large size (about 90 μ), arranged in two rows ; rostellum small and bluntly pointed. Genital pores unilateral, situated in the extreme anterior corner of the segment. Cirrus sac large and muscular ; genital atrium present ; testes of small size situated lateral to and in front of the ovary ; uterus breaks down into egg-capsules each containing from five to nine eggs.

Type-species :—*Southwellia gallinarum* (Southwell, 1921).

Moghe (1925) erected this genus to accommodate *Monopylidium gallinarum* Southwell, 1921, a species which differed from all other species of *Monopylidium* in the following combination of characters :—

Hooks very numerous (120), of large size (90 μ) ; small sized testes (35 μ in diameter), some of which are situated in front of the ovary ; unilateral genital pores, situated at the extreme anterior corners of the segments ; and in the fact that there are from five to nine eggs in each capsule.

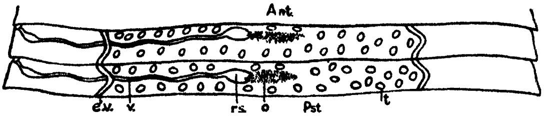


Fig. 331.—*Southwellia gallinarum.* Horizontal section of mature segments, × 33. (After Southwell.)

Southwellia gallinarum (Southwell, 1921). (Fig. 331.)

Synonym :—*Monopylidium gallinarum* Southwell, 1921.

From the domestic fowl ; Berhampur, Bengal. Southwell.

The worm attains a length of 2·1 cm. and a breadth of 2·5 mm. All the segments are broader than long, and even the posterior ones are very short. The segments number about 130. The genital pores are unilateral and situated at the extreme anterior corner of the segment. The head is prominent and measures about 300 μ in length by 500 μ in breadth. The rostellum is retracted and appears as a small bluntly pointed projection, armed with about 120 hooks, each measuring about 90 μ and arranged in two rows. The suckers are large, conspicuous, and unarmed. There is no neck.

The outer longitudinal muscular layer consists of a large number of separate dorsal and ventral strands. The lateral water vessels are large and clearly seen, both in the entire worm and in sections.

There are about 30 globular testes, each measuring about 35 μ, and they are situated for the most part on each side of the ovary, although a few lie in front of it. The cirrus sac is large and muscular, and the genital atrium runs anteriorly.

The ovary is situated in the middle of the segment, slightly posterior and median to the receptaculum seminis; it measures about 60 μ in length and 225 μ in breadth. A receptaculum seminis lies on the pore side of the ovary and measures about 45 μ by 15 μ. There are from five to nine eggs in each capsule. The outer egg-envelope measures about 35 μ and the oncospheres about 25 μ.

Genus IV. **PROCHOANOTÆNIA** Meggitt, 1924.

Synonym :—*Choanotænia* Lühe, 1910.

Rostellum armed with a single crown of hooks. Genital pores irregularly alternate. Genital ducts pass between the longitudinal excretory vessels. Vesicula seminalis absent, replaced by coils of vas deferens. Testes numerous, posterior to female glands. Uterus branched, breaking down into egg-capsules, each of which usually contains a single egg. Adults in birds.

Type-species :—*Prochoanotænia marchali* (Mola, 1907).

Prochoanotænia microsoma (Southwell, 1922). (Figs. 332 & 333.)

From (1) The eastern baya (*Ploceus atrigula*), and (2) the crested bunting (*Melophus melanicterus*); Zoological Gardens, Calcutta. Southwell.

The worm measures from 4 to 8 mm. in length and has a maximum breadth of about 630 μ. It consists of from 25 to about 50 segments. All the segments are broader than long. The genital pores, which are large and prominent, are irregularly alternate and are situated at the extreme anterior angle of the segment. The head is square and measures 220 μ; the suckers have a diameter of 140 μ. The rostellum measures about 180 μ in length and 50 μ in breadth; its anterior extremity is expanded and has a length of about 40 μ and a breadth of 90 μ. It is armed with a single row of from 16 to 20 hooks each of which measures about 35 μ. There is no neck.

As the material was not sufficiently well preserved, details of the muscular, excretory, and nervous systems are not known.

There are from 16 to 20 testes situated posteriorly to the ovary. When fully mature they have a diameter of about 36 μ. The cirrus sac is short and narrow, extending to the water vessel to which it is dorsal; it lies anterior to the vagina. The cirrus is remarkable in having its extreme tip armed with short spines set at right angles to its length. Immediately median to the tip, it is armed with a number of hooks of a different shape which measure 30 μ in length, and which lie parallel to its length. The vas deferens dilates close to the median extremity of the cirrus sac into a small seminal vesicle, and then continues in the median direction as a very fine tube.

Fig. 332.

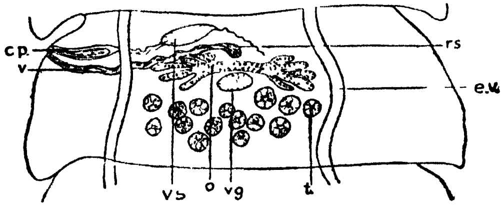
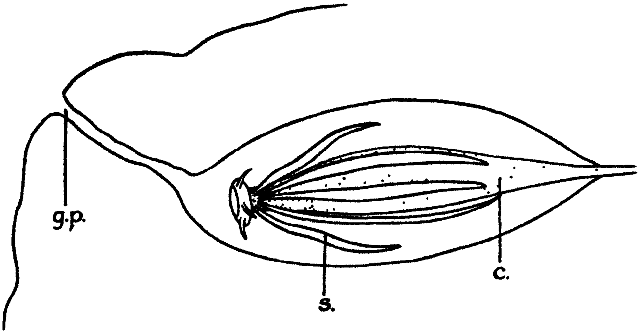


Fig. 333.



Prochoanotænia microsoma.

Fig. 332.—Mature segment, × 153. (After Southwell.)
Fig. 333.—Showing spinous cirrus, × 750. (After Southwell.)

The ovary lies quite anteriorly and is divided into two sets of acini, one on each side, widely separated from each other. The vagina is a wide muscular tube running behind the cirrus sac and dorsally to the excretory vessel. Near the centre of the segment it dilates into a globular receptaculum seminis having a diameter of about 36 μ. The vitelline gland is a compact, deeply staining organ lying posteriorly to a line joining the two wings of the ovary; it has a breadth of about 110 μ. The shell gland lies immediately anterior to the vitelline gland; it is somewhat globular and has a diameter of about 30 μ. The uterus appears suddenly as a transverse sac just in front of the ovary. In the next segment the ovary and testes have entirely and as suddenly disappeared, the whole segment being occupied by egg-capsules, each containing a single egg.

Genus V. **MALIKA** Woodland, 1929.

Rostellum armed. All proglottides (save occasionally the terminal ones) considerably broader than long. Genital pores unilateral. Genital ducts pass between the excretory canals. A single set of genitalia in each segment. Ovary poral. Uterus sacciform, resolving into capsules, each containing several eggs. Adults in birds.

Malika œdicnemus Woodland, 1929. (Fig. 334.)

From the stone-curlew (*Œdicnemus scolopax*); near Allahabad, United Provinces. Woodland.

The worm attains a length of 6 cm. and a maximum breadth of 1·6 mm. All the segments are broader than long except a few of the terminal ones. The genital pores are unilateral, on the left side, and situated a little in front of the middle of the lateral margin of the segment. The scolex measures 400 μ in length and 500 μ in breadth. The rostellum is well developed

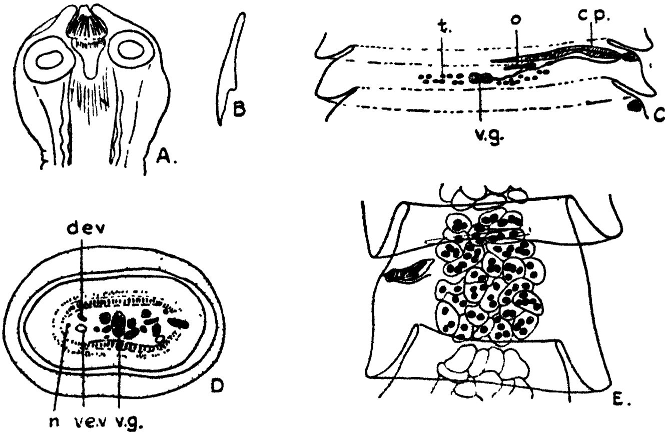


Fig. 334.—*Malika œdicnemus.* A, head, × 37; B, rostellar hook, × 107; C, mature segment, × 26; D, transverse section of mature segment, × 19; E, gravid segments, showing egg-capsules, × 26. (After Woodland, in 'Parasitology.')

and when retracted measures 250 μ in length; it bears a single crown of about 30 hooks, each measuring about 73 μ. There is no neck.

Muscular System. The longitudinal muscles consist of two layers, viz., an inner of large bundles and an outer of small ones. Between them is a thin layer of transverse fibres and a second one of transverse fibres occurs immediately internal to the inner bundles. A single layer of minute longitudinal fibres lies just beneath the cuticle.

The ventral excretory vessel is much larger than the dorsal; the longitudinal nerve is situated internally to the inner layer of longitudinal muscles.

Male Genitalia. There are from 18 to 27 testes, in a transverse row, two or three layers deep and situated behind the ovary and vitelline gland. The cirrus sac is anterior to the vagina; it measures about 200 μ in length, 40 μ in breadth, and extends as far as the ventral excretory vessels; the cirrus is unarmed. Outside the sac the vas deferens forms an elongated mass of coils anteriorly to the ovary.

Female Genitalia. The ovary is poral and anterior; the vitelline gland is compact, irregular in form, and situated median and posteriorly to the ovary. The vagina, at its inner extremity, dilates into a receptaculum seminis. Both the male and female genital ducts pass between the dorsal and ventral excretory vessels and dorsally to the nerve. The uterus develops a number of lateral, branched, slender diverticula with dilated extremities full of eggs, extending to the ventral excretory vessels and finally occupying the whole of the medulla. Ultimately these diverticula become separated and form closely-packed capsules each containing from 3 to 13 oncospheres which measure 62 by 22 μ; the hooks measure 30 μ in length and each oncosphere is invested by a thin sheath.

Subfamily III. PARUTERININÆ Ransom, 1909.

Scolex armed or unarmed, rarely without rostellum. A single set of reproductive organs in each segment. Uterus single or double, with a single paruterine organ, or multiple with several paruterine organs into which the eggs pass in the final stage of development of the segment. Adults in birds.

Type-genus:—*Paruterina* Fuhrmann, 1906.

Key to Genera.

Fully gravid uterus consists of two spherical sacs	Metroliasthes, p. 185.
Fully gravid uterus tubular or globular	Rhabdometra, p. 186.

Genus I. METROLIASTHES Ransom, 1900.

Scolex unarmed, without rostellum. Genital pores irregularly alternate ; genital canals pass between dorsal and ventral longitudinal excretory vessels. Testes 20 to 40. Uterus single in origin and consisting, when fully developed, of two spherical sacs touching in the median line and more or less fused with one another. A paruterine organ develops in front of the uterus, and finally becomes transformed into a spherical egg-capsule. Adults in birds.

Type-species :—*Metroliasthes lucida* Ransom, 1900.

Metroliasthes lucida Ransom, 1900. (Fig. 335.)

From the domestic fowl ; Orissa. Southwell.

The worm attains a length of 20 cm. and a breadth of about 1·6 mm. The genital pores are situated a little behind the centre of the lateral margin of the segment. The posterior segments are about twice as long as broad. The worm is rather transparent, especially the gravid segments ; the posterior half of the strobila is characterized by a white spot (paruterine organ) in each segment, situated near the middle line. The head is almost spherical and measures about 600 μ in length by 750 μ in breadth. It bears neither hooks nor rostellum.

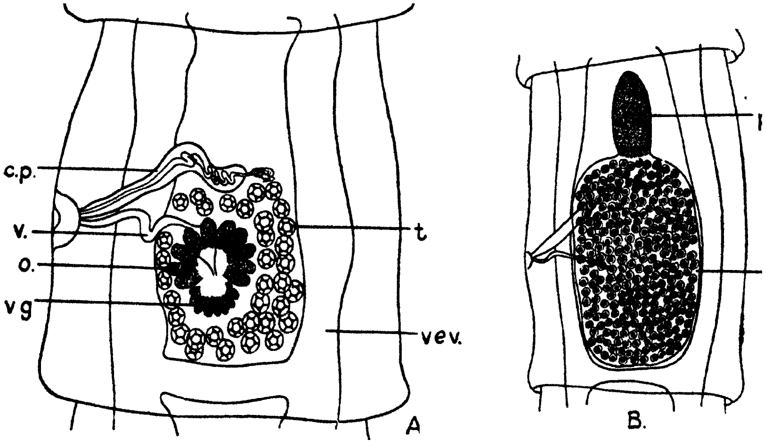


Fig. 335.—*Metroliasthes lucida*. A, mature segment, × 53 ; B, gravid segment, × 27. (Original.)

Muscular System. The longitudinal muscle fibres are disposed in a layer consisting of two parts, namely, an inner of about

100 large bundles, and an outer of isolated bundles of from 3 to 5 fibres scattered throughout the parenchyma. The transverse muscles lie in a thin band immediately within the longitudinal muscles.

Excretory System. There are two longitudinal vessels on each side, the ventral vessel being much the smaller.

Male Genitalia. There are from 35 to 40 testes in young segments, the number being reduced in older segments. The cirrus sac is flask-shaped and extends about a quarter the breadth of the segment. As usual, the vas deferens forms a number of coils immediately median to the cirrus sac.

Female Genitalia. The ovary is situated in the middle of the segment and is a simple sac-like organ divided into compartments. The vagina is a comparatively straight tube opening to the genital atrium just posteriorly to the cirrus; it runs towards the centre of the segment and then dilates into the receptaculum seminis. The vitelline gland lies posteriorly to the ovary and is, like the ovary, a sacculated structure. The shell gland is a small oval body lying between the vitelline gland and the ovary. The uterus at first is a transverse band of cells lying dorsally and slightly posteriorly to the ovary. Later on it occupies practically the whole of the segment behind the pore and bulges out the wall of the segment dorsally and ventrally. Shortly after eggs have appeared in the uterus modifications take place. Immediately in front of the uterus, within a cone-shaped area, the parenchyma becomes spongy and greatly thickened fibres develop. The latter eventually form a surrounding wall. This structure finally becomes the prominent paruterine organ, mentioned above, into which eggs from the uterus pass. The egg measures 75 by 50 μ and the oncosphere 30 μ.

Genus II. **RHABDOMETRA** Cholodkovsky, 1906.

Scolex unarmed, without rostellum. Genital pores irregularly alternate. Genital canals pass between the longitudinal excretory vessels. Testes posterior and lateral to female glands. Uterus median, tubular, and elongated longitudinally, or globular; a paruterine organ develops anteriorly to the uterus and extends forward nearly to the anterior border of the segments. Adults in birds.

Type-species :—*Rhabdometra tomica* Cholodkovsky, 1906.

Key to Species.

With 10 to 12 testes; longitudinal musculature in two layers	*R. dendrocitta*, p. 188.
With 20 to 30 testes; longitudinal musculature in a single layer..........................	*R. tomica*, p. 187.

(1) **Rhabdometra tomica** Cholodkovsky, 1906. (*Fig.* 336.)

From the painted partridge (*Francolinus pictus*); Zoological Gardens, Calcutta. Southwell.

The worm attains a length of about 7 cm. and a breadth of 1·5 mm. The posterior segments are longer than broad, measuring about 2·1 mm. in length and 900 μ in breadth; their posterior margins are bell-like in outline. The genital pores are irregularly alternate and situated a little in front of the middle of the lateral margin of the segment. The head is unarmed and without a rostellum; it has a length of 400 μ and a breadth of 540 μ. The suckers are prominent; there is no neck.

The longitudinal muscles are well developed and consist of a single layer of bundles which decrease in size externally. The circular muscles are also well developed; they lie immediately internal to the longitudinal bundles and have a thickness of 9 μ. The cuticle has a thickness of 5 μ. The dorsal excretory vessel on each side is extremely small and difficult to see, whilst the ventral vessel is very large and situated laterally. The ventral vessels communicate with each other by a wide canal in the posterior part of each segment. The genital ducts pass between the excretory vessels.

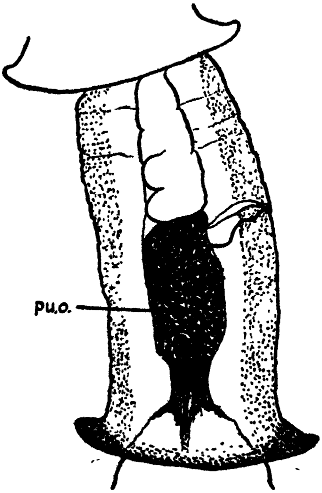


Fig. 336.—*Rhabdometra tomica.* Gravid segment, × 16. (Original.)

There are from 20 to 30 testes, situated in a group, in the posterior part of the segment, behind the female organs, and extending laterally and anteriorly to the ovary. The cirrus sac is rather large and extends slightly median to the ventral excretory vessel. The vas deferens is much coiled and runs towards the anterior median part of the segment.

The ovary is large and globular, situated in the posterior part of the segment; immediately behind it is the somewhat U-shaped vitelline gland. The vagina lies posteriorly to the cirrus sac and is a rather wide tube pursuing a curved course to the ovarian region, where it dilates into a small receptaculum seminis. The uterus arises in front of the ovary as a rather wide tube running antero-posteriorly; a paruterine organ develops in front of the uterus and extends in the median direction to the anterior border of the segment. The egg is oval and has a length of about 40 μ.

(2) **Rhabdometra dendrocitta** Woodland, 1929. (Fig. 337.)

From *Dendrocitta rufa*; Allahabad, India. Woodland.

The worm varies in length from 4 to 6 cm. and has a maximum breadth of 1 mm. Gravid segments may be twice as long as broad with the posterior margin expanded. The genital pores are irregularly alternate and are situated towards the anterior extremity of the lateral margin of the segment.

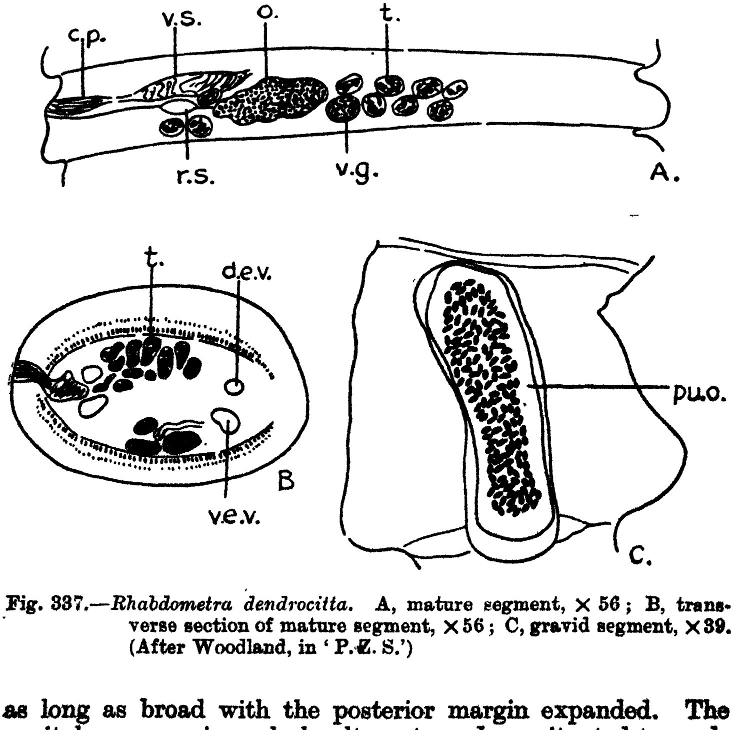


Fig. 337.—*Rhabdometra dendrocitta.* A, mature segment, × 56; B, transverse section of mature segment, × 56; C, gravid segment, × 39. (After Woodland, in 'P. Z. S.')

The genital ducts pass between the dorsal and ventral excretory vessels and ventral to the nerve. The scolex is very short, broader than the succeeding neck region, and measures about 20 μ in length and 600 to 800 μ in breadth. There is no rostellum and the head is entirely unarmed ; a neck is absent.

The longitudinal muscles are in two layers of bundles, external to which is a very thin layer of transverse fibres.

The ventral excretory vessels are larger than the dorsal and the former are in communication in the posterior part of the segment.

Male Genitalia. There from 10 to 12 testes, situated dorsally in a median group. The cirrus sac is small, measuring 160 μ in length, and opens anteriorly to the vagina into a small genital atrium. The vas deferens forms a conspicuous mass of coils surrounding a large retractor muscle.

Female Genitalia. The ovary at first is large, sac-shaped and situated slightly porally ; later on it becomes an ovoid sac with a limiting wall, and this is the uterus of gravid segments, *i. e.*, the ovary becomes transformed into the uterus. At its aporal extremity there is a spherical vitelline gland which gradually disintegrates. A shell gland could not be detected. The vagina is a narrow tube which dilates near the middle of the segment into a small receptaculum seminis. The paruterine organ develops from the poral end of the uterus ; it finally appears as a spherical sac projecting beyond the posterior border of the segment, and eggs are liberated by the bursting of this sac. The ripe eggs contain elongated embryos which measure about 55 μ in length, 9 μ in breadth, and are pointed at both ends.

Family VI. MESOCESTOIDIDÆ Fuhrmann, 1907.

Scolex without rostellum or hooks. Suckers unarmed. A single set of reproductive organs in each segment. Genital pores on ventral surface of segment, median. Eggs in gravid segments enclosed in a single thick-walled capsule. Adults in birds and mammals.

Type-genus :—*Mesocestoides* Vaillant, 1863.

Genus **MESOCESTOIDES** Vaillant, 1863.

Synonyms :—*Monodoridium* Walter, 1866.
Ptychophysa Hamann, 1885.

With characters of the family.

Type-species :—*Mesocestoides ambiguus* Vaillant, 1863.

Key to Species.

Testes extending laterally to excretory vessels ..	*M. lineatus*, p. 190.
Testes not extending laterally to excretory vessels	*M. mesorchis*, p. 192.

(1) **Mesocestoides lineatus** (Goeze, 1782) Railliet, 1893. (Fig. 338.)

Synonyms:—*Tænia lineata* Goeze, 1782.
Halysis lineata (Goeze, 1782) Zeder, 1803.
Tænia canis lagopodis Rudolphi, 1810.
Tænia pseudoelliptica Baillet, 1863.
Tænia pseudo-cucumerina Baillet, 1863.
Ptychophysa lineata (Goeze, 1782) Hamann, 1885.
?*Mesocestoides litteratus* (Batsch, 1786) Dolley, 1894.

Apparently the species cannot be differentiated from *M. litteratus* (Batsch, 1786) Dolley, 1894.

From (1) *Felis tigris*; Zoological Gardens, Calcutta. Southwell. (2) Dogs; Civil Veterinary Department, Lahore, Punjab.

The worms measure from 30 cm. to 2·5 m. in length and have a maximum breadth of about 3 mm. The terminal segments are much longer than broad and frequently measure 5 mm. in length and about 2 or 3 mm. in breadth. The genital pores are situated on the ventral surface near the middle. In fresh specimens the strobila sometimes shows a light reddish colour along the longitudinal axis. The head measures about 700 μ in diameter; there is no rostellum, but in its place there is a slight terminal depression. The neck is very short.

Male Genitalia. There are about 50 large testes scattered throughout the segment and extending laterally to the longitudinal excretory vessels. From the mid-dorsal line to the anterior extremity of the segment the vas deferens is thrown into a number of coils; anteriorly it turns sharply and runs to the cirrus sac, which is situated in the anterior part of the segment. The cirrus sac is very prominent and pyriform; the pore lies irregularly a little to the right or a little to the left of the median line. The cirrus may measure up to 1 mm. in length and it has a dilated base.

Female Genitalia. The ovary is bilobed and is situated in the posterior quarter of the segment. The bilobed vitelline gland lies partly posterior and partly ventral to the ovary. The vagina does not bear a receptaculum seminis. The uterus consists of an elongated cylindrical sac in the median longitudinal axis of the segment. Its anterior part presents a curve on one side and in this concavity the cirrus sac always lies. The posterior part of the uterus dilates and becomes trans-

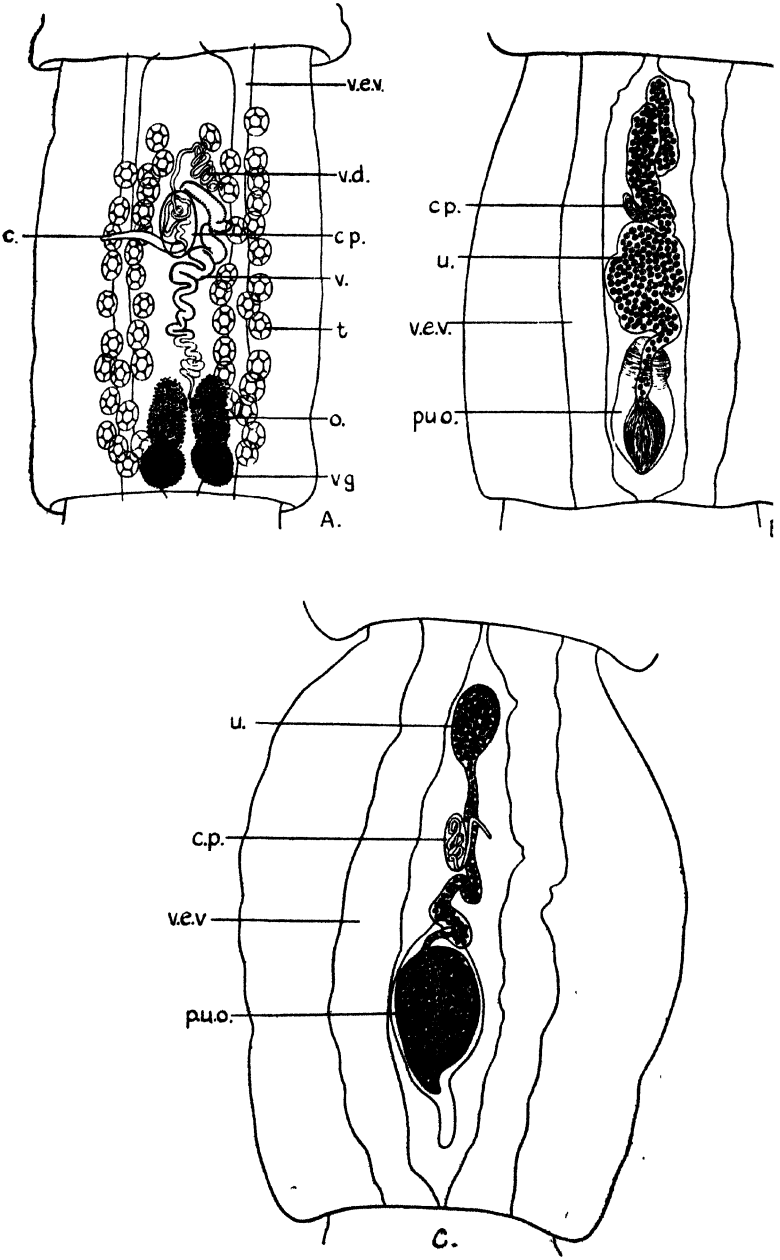


Fig. 238.—***Mesocestoides lineatus.*** **A, mature segment, × 53; B, gravid segment, showing fully expanded uterus, × 27; C, gravid segment, showing fully expanded paruterine organ, × 27. (Original.)**

formed into an egg-capsule, the remaining part of the uterus persisting as a cord-like structure. The egg measures from 40 to 60 μ in length and about 35 to 43 μ in breadth.

(2) **Mesocestoides mesorchis** Cameron, 1925.

From the Tibetan fox (*Vulpes ferrilatus*).

The worms attain a length of 7·5 cm. and a maximum breadth of 1 mm. The gravid segments assume the form of cucumber seeds, mature segments are more rectangular, and the immature segments are broader than long. The margin of the strobila is smooth. Calcareous corpuscles are abundant, and, unless the parasite is fixed in an acid medium, they almost obscure the genital organs in stained segments. The genital pore is situated on the flat side (ventral), slightly in front of the middle. The scolex has a diameter of about 500 μ and is unarmed. The suckers have a diameter of 200 μ ; they are very muscular and their cuticular lining is thrown into a large number of minute irregular projections. The musculature of the suckers is not complete posteriorly. The neck has a length of about 1 mm.

The musculature consists of a rather thick layer of longitudinal bundles limited internally by a thin layer of transverse muscles.

The excretory system consists of two longitudinal vessels on each side ; the outer vessel is small and disappears in mature segments, and the inner vessel increases in size, becoming large and conspicuous ; the latter are in communication with each other by a large transverse vessel situated near the posterior margin of each segment.

There are about 50 testes in each segment and they are confined to the space between the large longitudinal canals ; in this point the worm differs from *M. lineatus*. The cirrus sac is almost spherical and has a diameter of about 150 μ. Along with the vagina it opens into a flat discoid atrium, which opens to the exterior by a pore. The cirrus is long and capable of extending to the margin of the segment.

The ovary is strongly bilobed as in the genus *Tænia* ; it is situated posteriorly and lies dorsally to the vitelline gland. The latter organ is composed of two spherical structures usually situated near the centre of the ovary. A small shell gland surrounds the oviduct at the point where it joins the uterus. The vagina is a very long convoluted tube three times the length of the segment. The uterus is a thin walled tube arising at the level of the anterior margin of the ovary ; it passes lateral to the central vagina and cirrus, runs anteriorly, where it ends blindly, there being no uterine pore. A globular paruterine organ develops in gravid segments in the posterior third of the uterus, and into this structure the eggs pass.

The species apparently differs from *M. lineatus* in that the testes do not extend laterally to the excretory vessels.

DITHYRIDIUM Rudolphi, 1819 (Piestocystis Diesing, 1850).

This name is applied to those larval cestodes which possess a solid body without caudal bladder and which are more or less elongated. The scolex (which is unarmed) is invaginated into the body and bears four suckers. They are believed to be larval forms of species of the genus *Mesocestoides*.

Meggitt (1927) records the following species from Burma :

(*a*) DITHYRIDIUM sp. I. From *Rhabdophis stolatus*. Common in the intestinal wall and mesentery, the cysts having a diameter of from 700 μ to 1·2 mm. The larva, when extended, measures 2 mm. by 1 mm. and is solid ; it has no distinct head, no armature, and no invaginations. One extremity bears four feeble suckers ; the parenchyma contains numerous calcareous corpuscles.

(*b*) DITHYRIDIUM sp. II. From *Dichoceros bicornis*. The cysts occur in the liver, each one having a maximum diameter of about 3 mm. The larvæ are devoid of scolex and armature, but at one end there is an invagination terminating in four suckers, whilst at the other end there exists a small pore leading into small narrow chambers.

(*c*) DITHYRIDIUM sp. III. From *Ophites jara*.

(*d*) DITHYRIDIUM sp. IV. From *Bungarus multicinctus*. A single specimen from the intestinal wall.

(*e*) DITHYRIDIUM sp. V. From *Oligodon purpurescens*.

Family VII. NEMATOTÆNIIDÆ Lühe, 1910.

Strobila cylindrical. Scolex unarmed, without rostellum. External segmentation incomplete, only corresponding with internal posteriorly. A single set of reproductive organs in each proglottis. Cirrus and vagina open near one another into an alternating genital atrium whose marginal position is only recognizable from the course of the longitudinal nerve and excretory system. Genital ducts pass dorsally to longitudinal excretory vessels and nerve. Testes one or two, dorsal. Ovary and vitelline glands ventral, the latter dorsal to the former. Uterus breaks down early, the eggs subsequently becoming enclosed in paruterine capsules. Adults in amphibia.

Type-genus :—*Nematotænia* Lühe, 1899.

Genus **NEMATOTÆNIA** Lühe, 1899.

Testes two, dorsal. Ovary ventral, slightly poral. Uterus horse-shoe-shaped, disappearing early; as a result of the development of numerous paruterine organs, the eggs become enclosed in from 13 to 30 egg-capsules, each containing three or four eggs, which are scattered throughout the proglottis. Adults in amphibia.

Type-species :—*Nematotænia dispar* (Goeze, 1782).

? **Nematotænia dispar** (Goeze, 1782) Lühe, 1899.

Synonym :—*Tænia dispar* Goeze, 1782.

From (1) *Bufo melanostictus*; India. Southwell. (2) *Bufo* sp.; Lucknow, India. Southwell.

A few fragments with one damaged scolex were referred by Southwell, with considerable hesitation, to the above species. The largest fragment measured 7 mm. in length, the anterior extremity being unsegmented. The worms were circular in cross-section; no details of the internal anatomy could be determined.

Family VIII. AMABILIIDÆ Fuhrmann, 1908.

Scolex with armed rostellum, suckers unarmed. Proglottides with lateral appendages. A double or single set of reproductive organs in each proglottis. Male genital pores marginal. Vaginal pore absent, replaced by the marginal, ventral, or dorsal opening—never near the male pore—or by an accessory canal. Adults in birds.

Type-genus :—*Amabilia* Diamare, 1893.

Genus **AMABILIA** Diamare, 1893.

Synonym :—*Aphanobothrium* Linstow, 1906.

Scolex small, with armed rostellum. A double set of male reproductive organs in each proglottis. Cirrus armed with strong spines. Testes numerous, median. Female organs single in each proglottis, median. Accessory vagina opening ventrally, communicating (?) with a canal from the excretory system. Uterus a cage-like meshwork.

Type-species :—*Amabilia lamelligera* (Owen, 1835).

Amabilia lamelligera (Owen, 1832, ?1835) Diamare, 1893. (Fig. 339.)

Synonyms :—*Tænia lamelligera* Owen, 1832.
Amabilia lamelligera (Owen, 1832) Diamare, 1893.
Aphanobothrium catenatum Linstow, 1906.
Amabilia catenata (Linstow, 1906) Fuhrmann, 1908.

From the flamingo (*Phœnicopterus roseus*); Weligatta, Ceylon. ? Willey.

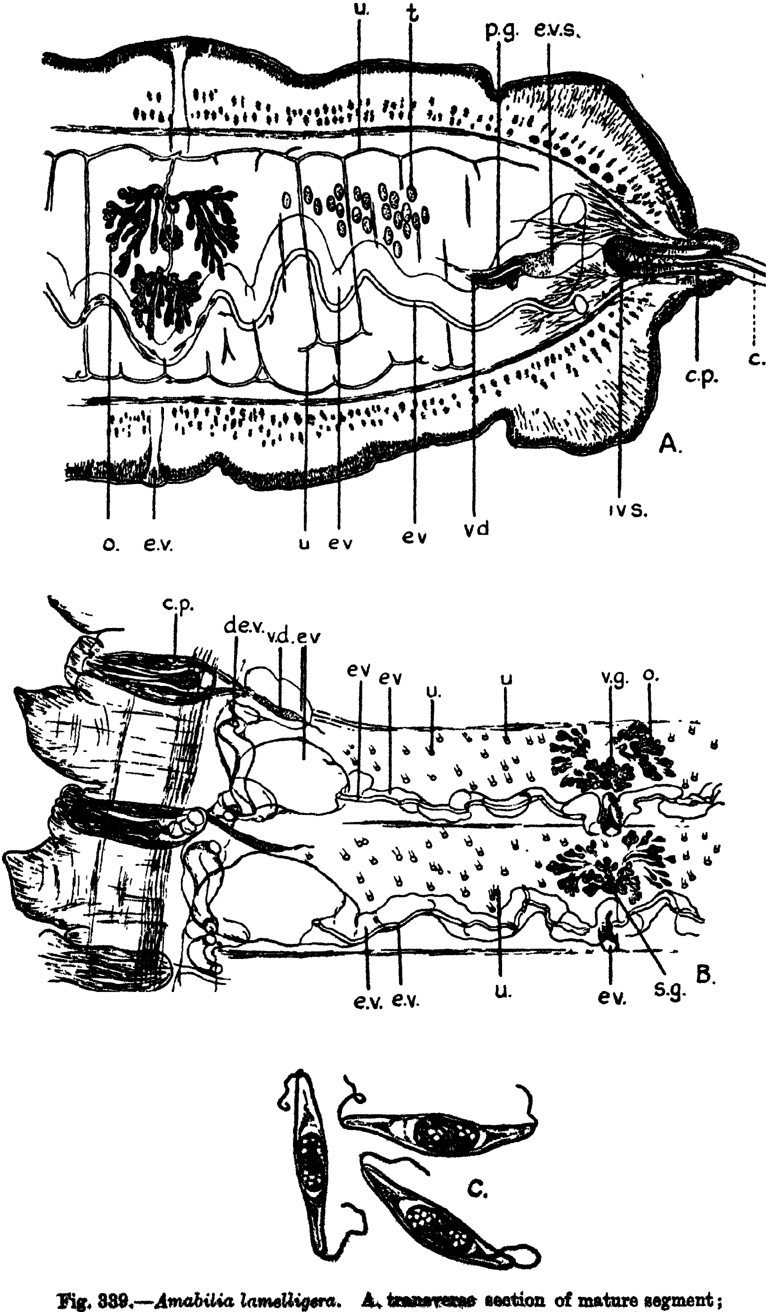


Fig. 339.—*Amabilia lamelligera.* A, transverse section of mature segment; B, horizontal section of mature segment; C, eggs. Magnification unknown. (After Clausen.)

The worm attains a length of 14 cm. and a breadth of from 9 to 10 mm. The strobila is attenuated anteriorly and truncated posteriorly ; it has a thickness of about 4 mm. The segments are broader than long, those in the middle and posterior part of the body having a length of 1 mm. The posterior lateral corners are salient. The genital pores are double and are situated at the extreme anterior corner of the lateral margin of the segment. Each of the latter contains a double set of male and a single set of female organs. The genital pore consists of only the opening of the vas deferens. There are two accessory vaginæ, one opening dorsally and the other ventrally ; apparently they communicate with a canal from the excretory system.

The scolex is very small and bears anteriorly a minute retractile rostellum ; no mention of hooks is made by either Linstow or Clausen.

Muscular System. This is strongly developed ; the longitudinal muscles consist of two or three layers of bundles, the internal layer being most pronounced. The transverse muscles are also well developed, and are situated internally to the longitudinal muscles.

The ventral excretory vessels are large and thin-walled, whilst the dorsal ones are small and thick-walled.

Male Genitalia. These are double in each segment. There are about 200 testes, about half of which are in communication with the cirrus on one side, the other half being in communication with the cirrus on the other side of the segment. They are disposed in several layers dorso-ventrally and develop rapidly ; they also disappear very suddenly, so that when the rudiments of the uterus become visible they have entirely degenerated. The vas deferens runs from the vicinity of the uterus to the cirrus sac in a straight or slightly undulating course. The part immediately internal to the cirrus sac is surrounded by prostatic cells. An external seminal vesicle is present. Inside the cirrus sac the vas dilates into an internal seminal vesicle with thick muscular walls, which entirely fills the sac. The cirrus and the internal seminal vesicle are surrounded by unicellular (? prostatic) glands. The cirrus is armed with a large number of closely set spines measuring 10μ, each of which has a broad base ; it is also furnished with a retractor muscle. The cirrus sac is very muscular and opens to a genital atrium situated on a large, prominent, conical papilla. The vas deferens passes between the excretory vessels and dorsally to the nerve.

Female Genitalia. The ovary is ventral and situated close to the anterior border of the segment ; it consists of two wings. It has a transverse diameter of 1·5 mm. and a dorso-ventral diameter of 1·1 mm. Each wing consists of a number of digitiform lobes arranged fan-wise. The vitelline gland lies dorsally and posteriorly to the ovary and measures from 660 to 760 μ transversely and 57 μ dorso-ventrally. The shell gland is large and measures 280 μ in diameter ; it is situated in the median line between the two lobes of the ovary just anterior to the vitelline gland. Contrary to what occurs in other cestodes, the relatively small vagina in this species is stated by Clausen to open not into the genital atrium, but into a canal from the excretory system which discharges on the ventral surface of the segment in the median line. A large receptaculum seminis is present, which also, according to Clausen, opens into the dorso-ventral canal just dorsal to the vitelline gland. The uterus is a very curious structure, consisting of a loose network of canals which at first are very narrow. The two systems of canals, *i. e.*, uterine and excretory, round which calcareous corpuscles are particularly numerous, communicate with each other by numerous dorso-ventral canals, each one of which may be bifurcated. The egg has three membranes, the external one being fusiform, measuring about 140 to 160 μ in length and 32 μ in breadth ; it is prolonged at each pole into a filament which measures from 27 to 36 μ in length. The oncosphere measures 50 by 27 μ.

Family IX. DIPLOPOSTHIDÆ Poche, 1926.

Head with an armed rostellum. Mature segments broader than long. Musculature well developed. A single or double set, or a partial duplication of male and female genital organs, in each segment. Vaginal pore present or absent. Cirrus very large and armed with spines. Uterus a transverse sinuous sac. Adults parasitic in birds.

Type-genus :—*Diploposthe* Jacobi, 1896.

Genus **DIPLOPOSTHE** Jacobi, 1896.

Cestodes with short proglottides and an armed rostellum. Ovary and vitelline gland single, lobed, and situated in the middle of the segment. Vaginæ double, opening one on each lateral margin of the segment. Uterus simple, forming a transverse cavity ; testes usually three, rarely more numerous (seven), occupying, irregularly, the median zone of the segment. Each testis has several vasa efferentia which anastomose and form, on each side near the testes and ovary, a seminal vesicle, which is surrounded by prostatic cells ; it is continued as the vas deferens, which opens, one on each lateral margin of the segment, into a strong cirrus pouch which lies dorsally to the vagina. Cirrus very large and strongly armed. Ripe eggs with three envelopes.

Type-species :—*Diploposthe lævis* (Bloch, 1782).

Diploposthe lævis (Bloch, 1782) Jacobi 1896. (Fig. 340.)

Synonym:—*Tænia lævis* Bloch, 1782.

From (1) *Netta rufina*; (2) the tufted duck (*Nyroca fuligula*); (3) the eastern white-eyed duck (*Nyroca baeri*); Zoological Gardens, Calcutta. Southwell. (4) *Nyroca ferina*; and (5) ? *Strepsilas interpres*; Chilka Lake, Orissa, India. Southwell.

The worm measures up to 50 cm. in length and has a maximum breadth of from 3 to 9 mm. The segments are fleshy and broader than long; the genital pores are double in each segment. Strobilization begins immediately behind the head. The small scolex bears 10 hooks, each measuring from 16 to 21 μ in length. The testes are large and few, there being from three to seven in each segment (usually three); from each testis several vasa efferentia arise which anastomose; these form two coiled vasa deferentia, one on each side. A seminal vesicle is present, surrounded by prostatic cells. The cirrus sac, and especially the cirrus, is very strongly developed; the latter is often evaginated; it is armed with powerful hooks which measure from 8 to 14 μ in length, resembling in shape those on the head of a *Tænia* sp. The cirrus sac runs dorsally to the vagina. The single median ovary is bilobed, each wing being further divided into small tubules; the vitelline gland lies posteriorly to the ovary and resembles it in shape, but it is much smaller. The uterus is simple and transversely elongated, bearing large diverticula which extend dorsally and ventrally into the musculature.

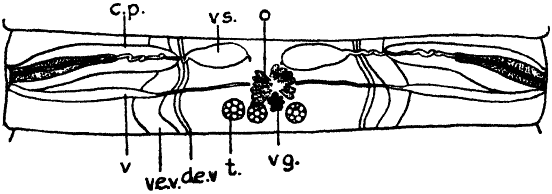


Fig. 340.—*Diploposthe lævis*. Mature segment, × 52. (Original.)

Family X. ACOLEIDÆ Ransom, 1909.

Scolex generally armed, seldom without rostellum. Suckers unarmed. Strobila thick, with short segments. Musculature consists of at least two layers of longitudinal muscles alternating with layers of transverse muscles. A single set, double set, or partial duplication of reproductive organs in each segment. Male genital openings marginal. Female genital (vaginal) opening lacking. Cirrus always very large and armed with strong hooks or spines. Eggs with thin transparent shells. Adults in birds.

Type-genus :—*Acoleus* Fuhrmann, 1899.

Genus **GYROCŒLIA** Fuhrmann, 1899.

Synonym :—*Brochocephalus* Linstow, 1906.

Rostellum armed with a single row of hooks arranged in a zig-zag with eight angles. A single set of reproductive organs in each proglottis. Male genital pores irregularly alternate. Cirrus sac passes between the longitudinal excretory vessels and dorsally to the nerve. Testes usually few. Receptaculum seminis small. Vagina absent. Uterus ring-like, with numerous out-pocketings and in gravid proglottides with two openings, one dorsal and the other ventral. Adults in birds.

Type-species :—*Gyrocœlia perversa* Fuhrmann, 1899.

Gyrocœlia paradoxa (Linstow, 1906) Fuhrmann, 1899. (Fig. 341.)

Synonym :—*Brochocephalus paradoxus* Fuhrmann, 1908.

From the lesser sand-plover (*Glareola lactea* = *Ægialitis mongolica*) ; Weligatta, Ceylon. ? Willey.

The worm attains a length of about 8·5 cm. and a breadth of 3 mm. All the segments are broader than long. The male genital pores are irregularly alternate and are situated at the extreme anterior corner of the lateral margin of the segment. The rostellum measures about 100 μ in length and 62 μ in breadth ; it is armed with a single zig-zag row (thrown into about eight angles) of hooks, about 78 in all, each of which measures about 29 μ.

The longitudinal muscles are strongly developed and consist of two layers of bundles alternating with layers of transverse muscle-fibres. Apparently there are from 20 to 30 testes situated dorsally and displaced somewhat aporally by the enormous cirrus sac. The latter organ is very muscular, and measures 400 μ in length and 18 μ in breadth, occupying one-third the transverse diameter of the segment ; it passes between the longitudinal excretory vessels and dorsally to the nerve. The cirrus is also enormous, broad, and strongly armed with spines ; it is as long as half the transverse diameter of the segment.

The ovary consists of two wings, each of which is somewhat lobulated ; it occupies the major portion of the segment ; the vitelline gland is posterior to it and is rather small. The shell gland is a minute globular organ, situated between the vitelline gland and the ovary. A vagina is absent.

At first the uterus assumes the form of a tubular ring; later on, numerous out-pocketings appear, the central area being filled with spongy tissue from which two short ducts open, one dorsal and one ventral, each by means of a pore.

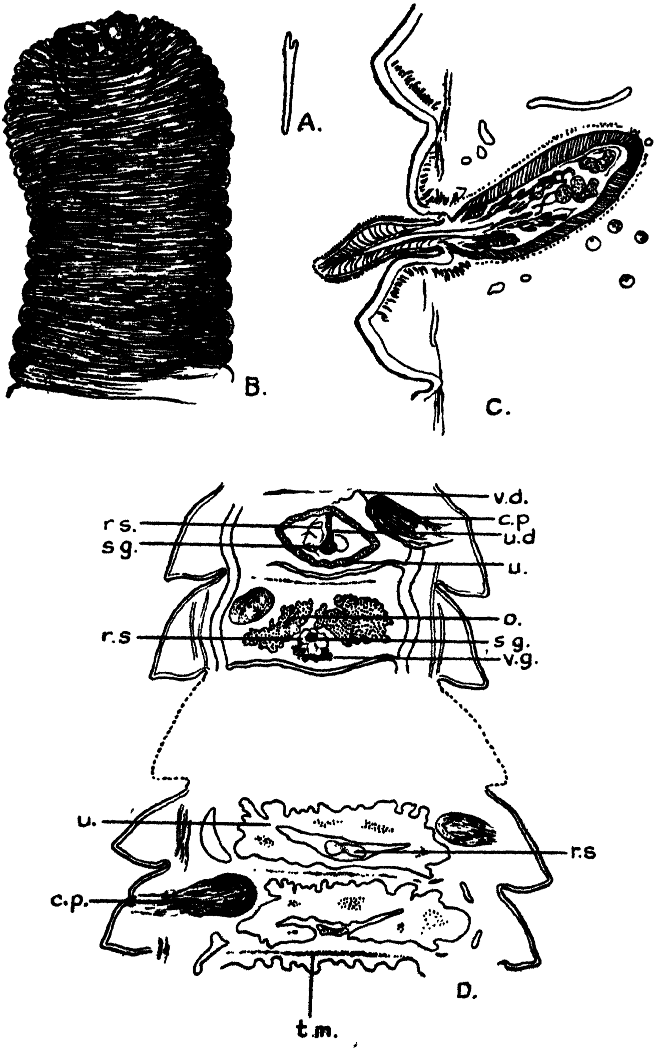


Fig. 341.—*Gyrocœlia paradoxa.* A, rostellar hook, magnification unknown. (After Linstow.); B, head; C, horizontal section, showing structure of cirrus pouch; D, horizontal sections of mature and gravid segments. Magnification unknown. (After Clausen.)

Family XI. TETRABOTHRIIDÆ Linton, 1891.

The systematic position of this family is a matter of some doubt. Fuhrmann (1907) placed it in the Cyclophyllidea. Nybelin (1922) considered that it was closely related to the Abothriinæ, and consequently placed it in the Pseudophyllidea. Poche (1925) agreed with Nybelin, and made the family into a tribe of the Bothriocephaloidea Diesing, 1850. Baylis (1926) points out that the genus *Dinobothrium* Ben., 1889, has affinities with the family Tetrabothriidæ, and proposed that the genus should be included in it.

The present writer includes the family in the superfamily Tænioidea. Characters :—Scolex unarmed, without rostellum. Suckers usually with an outwardly projecting auricular appendage on the anterior border. A single set of reproductive organs in each proglottis. Genital pores unilateral. Cirrus sac small and nearly spherical, usually united with the genital atrium by a muscular canal. Vitelline gland anterior to the ovary. Rudimentary uterine pore present or absent. Eggs with thin transparent envelopes. Adults in birds and mammals.

Type-genus :—*Tetrabothrius* Rudolphi, 1819.

Genus **TETRABOTHRIUS** Rudolphi, 1819.

Synonyms :—*Amphopterocotyle* Diesing, 1853.
Eutetrabothrium Diesing, 1854.
Prosthecocotyle Monticelli, 1892.
Bothridiotænia Lönnberg, 1896.

Acetabular appendages and muscular atrial canal present; genital pore on left side of strobila. Cirrus and genital atrium without, or with a few, hairs. Adults in birds and mammals.

Type-species :—*Tetrabothrius emmerinus* (Abildgaard, 1790).

Tetrabothrius erostris (Lönnberg, 1889) Fuhrmann, 1899.

Synonyms :—*Tænia erostris* Lönnberg, 1889.
Rhynchotænia erostris Lönnberg, 1889.
Prosthecocotyle erostris (Lönnberg, 1889) Fuhrmann, 1899.

From *Sterna bergi*; Negombo Lake and Tamblegam, Ceylon. ? Willey.

The worm measures up to 8 cm. in length and has a maximum breadth of about 3 mm. The scolex measures about 450 μ in length; each sucker bears a little lappet. The inner longitudinal muscles consist of from three to eight bundles.

There are from 30 to 32 testes. The cirrus sac measures about 60 μ in length; the genital pores are unilateral and are situated at the apex of a papilla.

Family XII. DIŒCOCESTIDÆ, nov.

Cestodes in which the sexes are separate, *i. e.*, some strobila contain only male and others only female organs.

Type-genus :—*Diœcocestus* Fuhrmann, 1900.

Genus **DIŒCOCESTUS** Fuhrmann, 1900.

Strobila diœcious. Scolex usually with armed rostellum. Male with a double set, female with a single set of reproductive organs, in each proglottis. Vagina irregularly alternate, reaching almost to the margin of the proglottis. Uterus a transverse sac with dorsal outgrowths. Adults in birds.

Type-species :—*Diœcocestus paronai* Fuhrmann, 1900.

Diœcocestus novæ-guineæ Fuhrmann, 1914. (Fig. 342.)

From the little grebe (*Podiceps albipennis*) ; Zoological Gardens, Calcutta. Southwell.

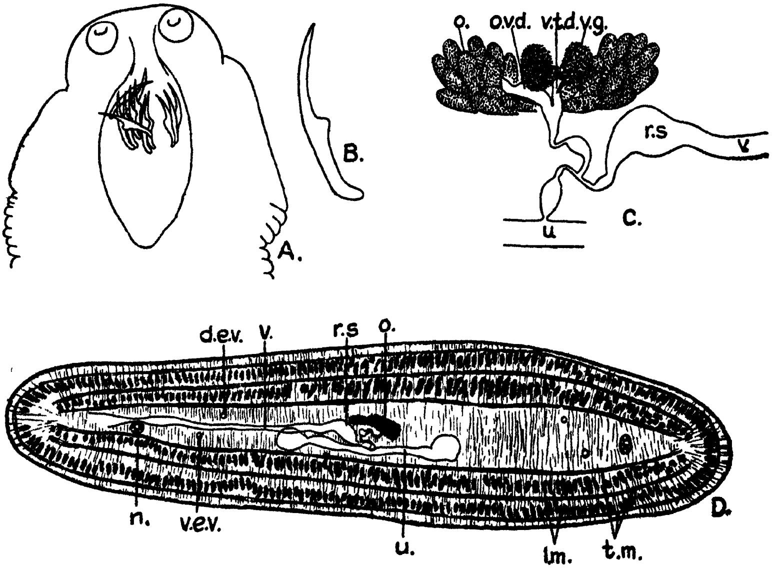


Fig. 342.—*Diœcocestus novæ-guineæ.* A, head of ♀, × 24 ; B, rostellar hook, × 42 ; C, female genitalia, × 80 ; D, transverse section of ♀, showing musculature and genitalia, × about 20. (Original.)

Two male worms and one female have been recorded from the above host. The former had a length of 10 cm., a maximum breadth of 5 mm., and a thickness of 1 mm.; the hooks were missing, and the only trace of genitalia consisted of two cirrus sacs in each segment, each of which measured 750 μ in length and 330 μ in breadth; the cirrus was apparently unarmed. The female worm measured 17 cm. in length, 6 mm. in breadth, and had a thickness of 1·6 mm.

All the segments are broader than long, the lateral posterior margins being salient. The head of the male worm had a length of 100 μ and a breadth of 60 μ, whilst the head of the female worm had a length of 800 μ and a breadth of 900 μ. As will be noted, the male heads are very small and are retractile within the anterior end of the strobila, which latter lies behind the head like two shoulders. Twelve hooks were counted on the female head, each hook having a length of 320 μ—it is possible that a few were missing; they resemble those figured by Lühe for *D. aspera* (Mehlis), but in the latter species the hooks measure only from 200 to 218 μ in length and are 14 in number.

The muscular system is well developed; the longitudinal muscles consist of two layers of bundles, the outer layer being almost as large as the inner layer. The circular fibres are in three layers, one layer external and another layer internal to the longitudinal muscles. The dorsal excretory vessel is feebly developed, having a diameter of 25 μ only. The ventral vessel has a diameter of 90 μ. Externally to the longitudinal excretory vessels there is a well developed nerve which has a diameter of 100 μ.

The ovary was not seen in its fully developed condition, but it is situated in the middle of the medullary parenchyma; the vitelline gland is a globular granular organ just posterior to the ovary. From the pore the vagina pursues an almost straight course to the middle of the ovary, where it dilates into a conspicuous receptaculum seminis.

The uterus arises ventrally to the ovary as a transverse tube which later on fills the entire segment and appears to be divided up into loculi by ingrowths of septa from the uterine wall. The egg has a diameter of about 42 μ and the oncosphere 25 μ. The hooks in the embryo have a length of 13 μ.

GENERA OF UNCERTAIN SYSTEMATIC POSITION.

Genus I. **ECHINOBOTHRIUM** van Beneden, 1850.

Van Beneden established this genus in 1850, but did not at that time define its characters. Braun did so, however, in 1900:—"The number of hooks on the head varies according to the species, and so does the number of hooks in the longitudinal rows on the neck. In many forms there is, on the anterior part of the head, a 'proboscis-like' collar which bears hooks having bowl-shaped bases. Genital pores in the middle of the ventral surface or near the posterior margin. Eggs with or without appendage.

"Type:—*Echinobothrium typus* van Ben., 1850."

(1) **Echinobothrium typus** van Ben., 1850. (Fig. 343.)

Synonym :—*E. boisii* Southwell, 1911.

From *Stoasodon narinari*; Pearl Banks, Ceylon. Southwell.

Van Beneden's description of the above type-species was as follows :—

"*First generation* a scolex (*scolexoïde*). *Second generation strobiloide* :—Body elongate, flattened, ending in a distinct hammer-shaped head bearing two rows of hooks ; three rows of spines on each side of the neck. The cirrus opens on the median line. Length of worm up to 5 or 6 mm. *Third generation* (*free proglottides*) :—Body elongated, circular, with no

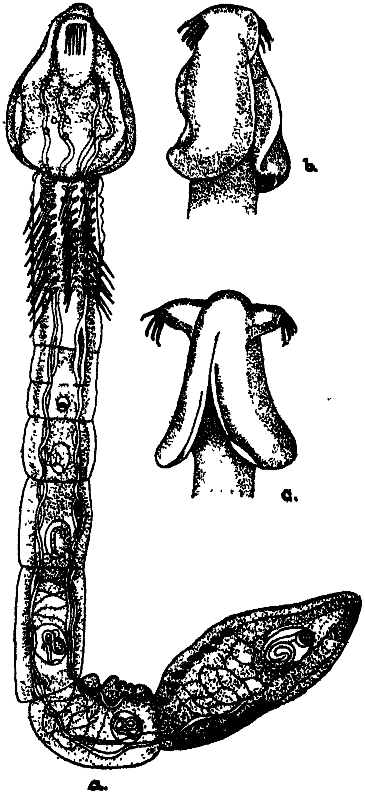


Fig. 343.—*Echinobothrium typus.* *a*, entire worm ; *b* and *c*, views of the head. Magnification unknown. (After van Beneden.)

other external opening except the opening of the flask-shaped cirrus. The cirrus is rugose at its base end and, when ejected, is almost as long as the body; the proglottid is 1 mm. in length. Eggs very small and not measuring more than 0·01 mm. The hooks on the head are in one row, and their point is slightly curved inwards; at its anterior third each hook bears a slight eminence or tubercle which is easily detached. There are nine hooks on each side.

"*Spines.* These are straight and slender, ending in three apophyses (tubercles) at the proximal end, by means of which they are fixed to the worm. They are arranged in three longitudinal rows of twelve to thirteen spines each.

"*Ovary.* This is situated at the side and occupies practically the whole length of the worm; it looks like a string of beads and is best seen when 'germs' are formed but not evacuated." (It is figured as a U-shaped organ.)

"*Vitelline glands.* Numerous cells, more or less irregular, fill the middle of the body." (They are shown laterally, in front of the ovary, in van Beneden's figure.)

"*Testes.* In the body one sees an organ, dull in colour, which presents the form of a coiled-up cord like the testicle of an insect. It has a definite wall and could be uncoiled."

For a long time van Beneden believed that this cord terminated at the base of the cirrus, but was never able to satisfy himself on this point. He regarded this organ as the testicle or "spermogene," but did not believe that it passed its products to the exterior.

"There is complete hermaphroditism.

"*Affinities.* The worm must be placed in the neighbourhood of the armed Bothriocephalids, but cannot be included in any of the established genera."

In 1858 van Beneden defined the characters of the genus *Echinobothrium* as follows :—" A double rostellum with hooks; two big, very mobile bothridia, and a spiny neck."

He also added the following description of *E. typus* :—

"Length of strobila, 5 to 6 mm.; length of proglottis, 1 mm.

"*Scolex.* Head very mobile, flattened. The two bothridia seem joined together during life. The edges of the bothridia are denticulated; the bulb is armed with hooks inside the head, and extends anteriorly. There is a double rostellum armed with a double row of hooks. Beneath the bulb lies a bundle of muscular fibres. The hooks are arranged in a single row and point posteriorly. There are from nine to sixteen on each side. They occupy two planes, and are of the same length and shape, being broader at the base, the point bending slightly downwards. The longitudinal canals in the head are four in number. Neck well defined and flattened throughout. On each side there are three rows of spines; these are straight, pointed, and terminate, at their base, in three apophyses (tubercles). There are twelve or thirteen hooks in each row, pointing posteriorly. Neck as long as the head, but not as wide. Patches of red pigment occur beneath the spines.

"*Strobila.* There are from eight to ten segments; the last ones are two or three times longer than broad, the first ones being much broader than long. The penis opens on the same side in the median line.

"*Proglottides.* The penis is situated in the posterior third of the segment and is covered with spines. The testes are placed anteriorly in the middle of the segment and are made up of several transparent vesicles which fill the segment. The spermatic reservoir consists of a twisted canal, placed in the median line, at the base of the penis; the ovary consists of two long cæca situated posteriorly and joined at their base. Eggs 0·01 mm., pointed at one end, flattened and broad at the other. Shell simple and very thin, without filaments. They accumulate in a uterus which fills the whole segment."

Wagener, in 1854, referred to the species *E. typus*, a worm which Leuckart and Pagenstecher (1858) considered distinct, and which Diesing, in 1863, named *E. affine*.

ECHINOBOTHRIUM BOISI Southwell, 1911.

The author described this worm as follows:—"The worm measured 1 cm. long, but all the ripe proglottides were missing. The head is 2 mm. long, and consists of an anterior umbrella-like structure 1·3 mm. broad, bearing numbers of long, pointed, curved, yellow spines, or coronal hooks, clustered at each side. This is succeeded by a somewhat bulbous neck, devoid of spines and overhung, and somewhat hidden, by two lappets, which are united over the bulbous portion along the greater part of their length. It was not determined whether this neck was segmented or not. Succeeding the neck, and commencing immediately at the posterior end of the lappets, is an armed portion, or '*Kopfstiel*,' 1·3 mm. long. This bears eight longitudinal rows of minute teeth with 24 teeth in each row. These teeth are apparently triradiate, the paired shorter processes of each tooth being anterior, and their lateral terminations being either pointed or knobbed. The point of juncture of these parts of the teeth is somewhat thickened. The strobila commences immediately. The segments are first much broader than long, becoming square, then cylindrical. The sides and division lines of the segments are perfectly straight. Our worm had no ripe proglottides, so that no observations were made on the reproductive anatomy. One specimen. Portugal Bay. December 18, 1910."

(2) **Echinobothrium affine** Diesing, 1863. (Fig. 344.)

From *Carcharias* sp. and *Rhina halavi*; Negapatam, India. Pearson.

Worms of this species usually possess three, rarely four, segments. In every case the last segment was longer than the rest of the worm.

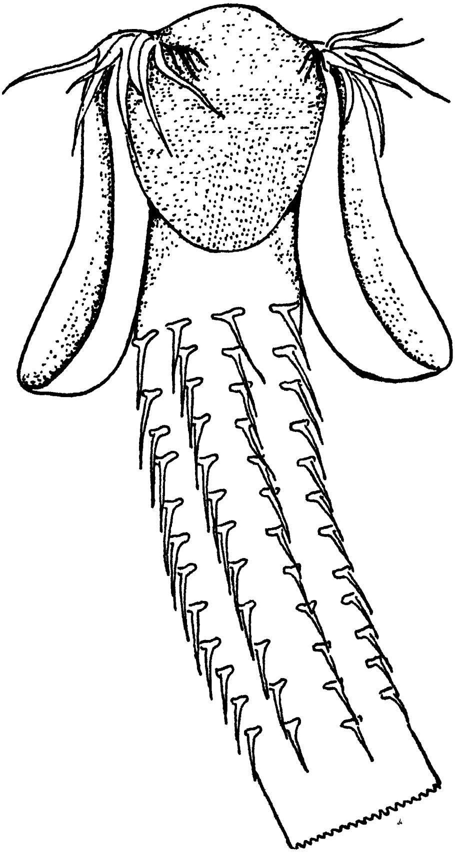


Fig. 344.—*Echinobothrium affine*. Head, × 340. (After Southwell.)

The 'Kopfstiel' bears eight longitudinal rows of hooks, each hook with three roots; the number of hooks in each row varies from twelve to fourteen, the usual number being twelve. The hooks decrease in size and length posteriorly, the anterior hooks being stout and measuring 65 μ in length, whilst the posterior hooks are very slender and measure only 35 μ in length.

On each side of the head there is a group of about eleven large hooks, the central hooks being slightly the largest and measuring 75 μ. On each side of each group of large hooks there are three or four minute hooks varying in size from 8 to 13 μ.

(3) **Echinobothrium rhinoptera** Shipley & Hornell, 1906.

From *Rhinoptera javanica*; Pearl Banks, Ceylon. Hornell

"Along with the *Eniochobothrium gracile* a few specimens of a curious Cestode which we place with the genus *Echinobothrium* were found. The specimens measured about 3 mm. in length, the head slightly over 0·2 mm. As a rule in the genus *Echinobothrium* the head is succeeded by a portion called the 'Kopfstiel' by German writers. This bears eight rows of very characteristically shaped spines. In our specimen, however, the head is borne by a long 'neck,' devoid of spines. This 'neck' is 0·3 mm. in length, and in the fresh condition it seemed strobilized, but in the stained and mounted preparations this seems not to be so much a real strobilization as a more or less wrinkling of the cuticle. Unfortunately, the number of specimens was so small that we could not settle this point by an appeal to the knife.

"The 'neck' is followed by an armed region 0·2 mm. long. This has eight longitudinal rows of characteristic *Echinobothrium* teeth, with their basal process, their long, fine point, and the two side rods at right angles to the rest. The number of teeth in each row was either twelve or thirteen. The armed region was greater in circumference than the neck. Behind, the body soon broke up into proglottides, and of these, seven or eight could be recognised as distinct. They increase very rapidly in size, and in our mounted specimen the seventh proglottis is 0·75 mm. in length and 0·2 mm. in breadth, and occupies a bulk of about one-half to one-third the rest of the body. The only internal organs visible are the testes, arranged much as those of *E. musteli* as figured by Pintner, the cirrus bulb and the cirrus. When the latter was exserted it was seen to bear very numerous minute recurved hooks. The two points in which this Cestode differs from the other members of the genus, e. g., *E. affine*, *E. typus*, *E. brachysoma*, and *E. musteli*, are the complete absence of any spines on the head and the presence of the naked region or 'neck' between the head and the armed region of the body. On the other hand the shape of the head with its four [*sic*] projecting lappets and its intervening spoon-like depressions, the armed region, the shape of the teeth, the number of the rows of teeth, the number of the proglottides, the arrangement of the testes, all resemble what we know of the genus, and justify us in including this amongst the species of *Echinbothrium.*"

The species differs from all other species in the genus in having an elongated unarmed portion of the worm situated between the head and the "Kopfstiel." The absence of hooks from the head is probably due to their having been lost.

(4) **Echinobothrium longicolle** Southwell, 1925. (Figs. 345, 346, & 347.)

From *Dasybatus kuhli*; Pearl Banks, Ceylon. Southwell.

The preserved worms measure from 2 to 3 cm. in length and are composed of about fifty segments. The genital pores are situated on the ventral surface in the posterior third of the segment.

Head. The head measures about 1·1 mm. in length and 900 μ in breadth; it is made up of two rounded or slightly elongated bothridia surrounding a central portion; no hairs were seen on the bothridia. Anteriorly the head terminates in a muscular disc formed by the fusion of the two bothridia and the central portion. This muscular extremity bears two separate crowns of hooks, one on each side; by means of powerful longitudinal and circular muscles the central area. of the terminal part of the head can be retracted, and when retracted a deep fossa is produced, at the mouth of which the two crowns of hooks come to be situated. Each crown contains about twenty hooks, and each hook has a length of about 90 μ. Spines similar to those on the collar of *E. musteli* were definitely absent. Immediately posterior to the two bothridia the "Kopfstiel" begins, and this structure is characteristic of the species; it measures about 5 mm. in length and is armed with an enormous number of hooks; there are about 180 hooks in each antero-posterior row, and eight hooks in each transverse row. These hooks are curved and have a length of about 35 μ; they arise from an irregularly shaped base; the point on one hook overlaps the base of the next posterior hook. Posteriorly to the "Kopfstiel" there is a short neck, measuring about 0·4 mm. in length.

No details regarding the muscular, excretory, and nervous systems are available, but a pair of excretory vessels were clearly seen in whole mounts, running along each lateral margin of the worm.

Male Genitalia. When immature the testes are situated in the median field, but when fully developed they occupy the entire anterior two-thirds of the segment; each testis has a diameter of about 120 by 90 μ when fully mature; the number of testes varies from twenty-six to thirty. The cirrus pouch is pyriform and opens on the ventral surface; the vas deferens is a long tube, bent upon itself but not coiled.

Female Genitalia. The ovary is situated quite posteriorly and is bilobed; each lobe consists of a few club-shaped acini radiating outwards fanwise. The vagina apparently follows a straight course from the ovary to the genital pore where it opens posteriorly to the cirrus pouch; shell gland small or absent. The vitelline glands are rather inconspicuous; they

Fig. 345.

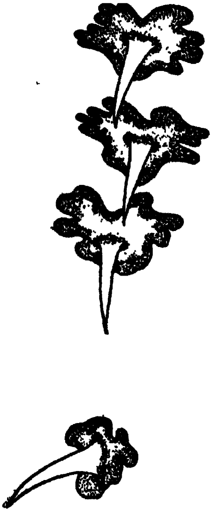


Fig. 346.

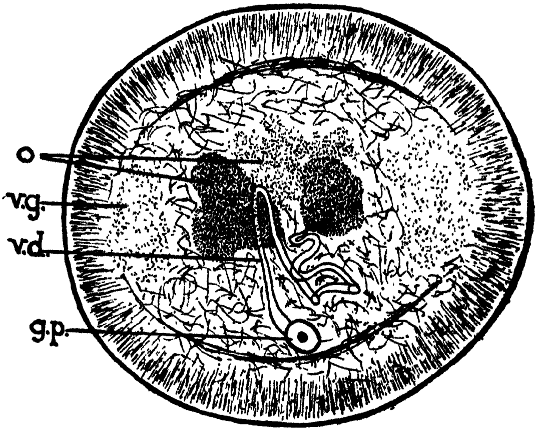
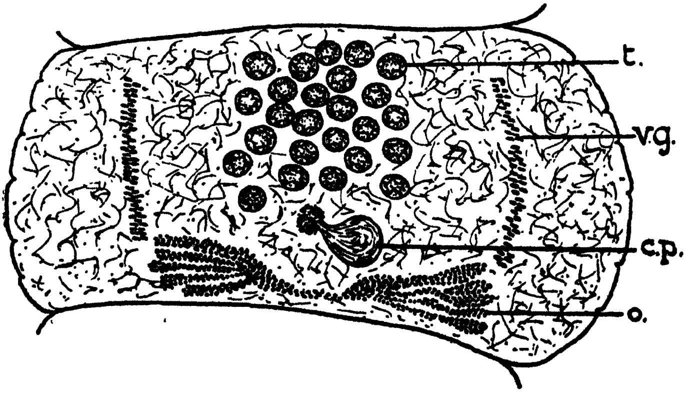


Fig. 347.



Echinobothrium longicolle.

Fig. 345.—Neck-hooks, × 500. (After Southwell.)
Fig. 346.—Transverse section of mature segment, × 69. (After Southwell.)
Fig. 347.—Mature segment, × 112. (After Southwell.)

are paired and are situated laterally. The uterus consists of a tube running along the median antero-posterior axis; the oviduct opens at its posterior extremity. In the last segments the uterus usually contains eggs; the majority of these are globular, but sometimes they are elongated, and bluntly pointed at one extremity. The eggs are separate and not in clusters.

This species is different from all other species in the genus in having the "Kopfstiel" armed with hooks, of which there are about 180 in each antero-posterior row, and eight in each transverse row.

Genus II. PILLERSIA Southwell, 1927.

The head is unarmed and is composed of two undivided bothridia. One surface of each bothridium is puckered and thrown into folds, resembling in this respect certain species of the genus *Phyllobothrium*. Accessory suckers are absent. Parasites in sharks and rays.

Type-species :—*Pillersia oweni* Southwell, 1927.

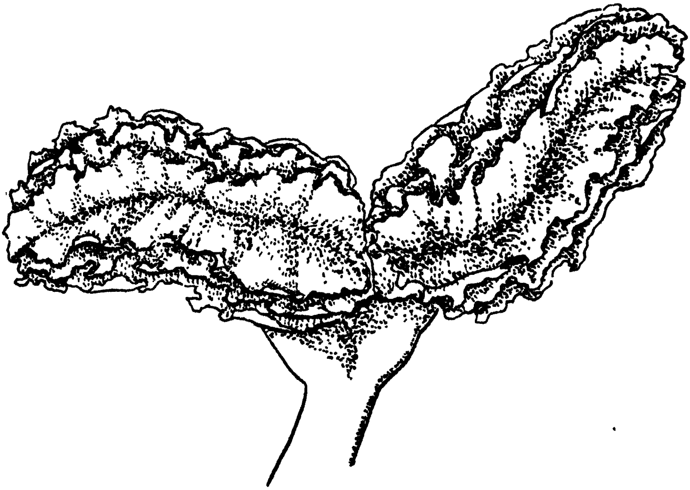


Fig. 348.—*Pillersia oweni*. Head, × about 60. (After Southwell.)

Pillersia oweni Southwell, 1927. (Fig. 348.)

From *Urogymnus asperrimus*; Pearl Banks, Ceylon. Southwell.

The longest specimen measures 1·8 cm. in length, 150 μ in breadth, and consists of a neck bearing at its anterior extremity two bothridia, each of which measures 800 μ in length, The bothridia extend laterally at an angle to the neck; their posterior surfaces are smooth, but their margins and anterior surfaces are puckered and folded very much as are those of *Phyllobothrium foliatum*. Accessory suckers are absent.

The neck is very long, measuring up to 1·8 cm. No segments were obtained and consequently a description of the genital organs is not possible. The species is easy to identify on account of the head bearing only two bothridia.

Genus III. **DISCOCEPHALUM** Linton, 1890.

"Body articulate, taeniaeform. Head composed of two parts. The anterior part a muscular disk which is entire, or notched at the edge. The posterior part (neck) short, globose, with an inflated or corrugated surface. Neck (unsegmented part of body) much narrower than head, continuous with body. No supplemental disks. Genital apertures marginal.

"Type species :—*Discocephalum pileatum*, from *Carcharias obscurus*." (*Linton.*)

Linton stated that this genus, together with the genera *Tylocephalum* and *Lecanicephalum*, should be placed in a new family, for which he suggested the name Gamobothriidæ.

(1) **Discocephalum pileatum** Linton, 1890. (Fig. 349.)

From *Carcharias gangeticus*; Pusser River, Khulna, Bengal, India. Southwell.

"Head, a transversely flattened apical disk, entire, or with a single lateral notch, followed by a much smaller, globular, inflated, cervical mass, with botryoidal or corrugated surface, yellowish in colour, and separated from the apical disk by a narrow, orange-coloured band; unsegmented part of body narrower than head, merging into segmented body. Anterior segments very short, much crowded; subsequent segments longer than broad; mature segments irregularly squarish, very changeable in living specimen. Strobile flat, increasing in breadth uniformly to the beginning of mature segments, beyond which point it is somewhat narrower.

"Genital apertures marginal a little in front of middle, male and female approximate. Cirrus long and slender, vagina opening in front of cirrus. Length (maximum), 530 mm.; diameter of anterior disk 3 to 5 mm.; greatest breadth of body 3 to 5 mm. *Habitat* :—*Carcharias obscurus*, spiral valve. Wood's Hole, Massachusetts, July 19, 1886. One adult, three young." (*Linton.*)

Linton differentiated two varieties, one having the apical disc entire and the other having a profound lateral notch in the apical disc. The measurements in millimetres of the single adult specimen were as follows:—Length, 530;

marginal diameter of disc, 3·5; lateral diameter of disc, 3; thickness of disc, 1·25; diameter of cervical mass, 2; breadth of unsegmented part of body, 1·12; greatest breadth of body, 115 mm. from head, 5; length of segments, 115 mm. from head, 1; length of posterior segments, 2·45; breadth of posterior segments, 3·25; longer diameter of ova, 0·11; shorter diameter of ova, 0·08.

Male Genitalia. The testes are arranged in racemose clusters on branches which are transverse to the axis of the segment; the clusters are granular and measure from 700 to 860 μ in diameter. The cirrus pouch is oblong when the cirrus is retracted, and it measures about 280 μ in diameter and 600 μ in length. The cirrus is very long, slender, and unarmed. Outside the pouch the vas deferens is voluminous and coiled, some of the coils having a diameter of 140 μ.

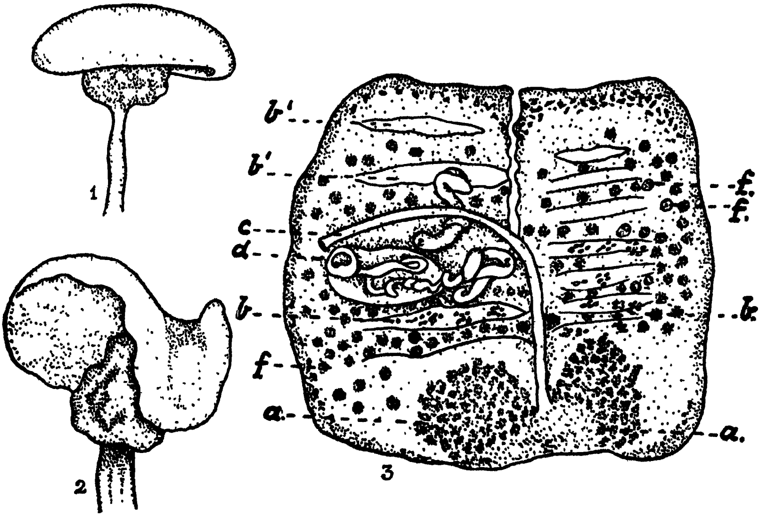


Fig. 349.—*Discocephalum pileatum.* 1 and 2, head, showing variations in appearance, × 9; 3, horizontal section of mature segment—*a*, ovary; *b*, uterine cavities with clusters of eggs; b^1, uterine cavities devoid of eggs; *c*, vagina; *d*, base of invaginated cirrus; *f*, testes. × about 8. (After Linton.)

Female Genitalia. The ovary lies posteriorly and is bilobed. From the pore the vagina runs in front of the cirrus pouch; it then turns abruptly and runs backwards to the ovary. The shell gland lies between the two lobes of the ovary; it has a diameter of about 90 μ, and is, in fact, a closely coiled tube. The vitelline glands are condensed into a single mass and are apparently situated posteriorly. Linton states that posteriorly the shell gland "connects with an irregular mass which I take to be the vitelline gland. This, when magnified . . . appeared as an irregular, slightly striated, glandular organ which was sharply differentiated from the surrounding parts and measured 0·2 mm. in length and 0·24 mm. in breadth." Linton was unable to differentiate the outlines of the uterus, but he noted that in mature segments there was a longitudinal dehiscent opening along the median line.

The eggs are oval, brown in colour, and measure 80 by 110 μ.

The worm is peculiar in having a single vitelline gland, which is situated posteriorly to the ovary. In this respect it resembles *Tylocephalum uarnak*.

Genus IV. **DIAGONOBOTHRIUM** Shipley & Hornell, 1906.

Head 2·3 mm. in length, about 1 mm. in breadth. There is a large terminal muscular sucker, and two ear-like bothridia, which run down right and left of the head. One edge of each of these bothridia runs forward obliquely, and loses itself in the crinkled membrane which surrounds the terminal sucker. There is only one edge on each side thus prolonged, and the two prolongations cross one another at about a right angle. The head is thus asymmetrical. The neck is long and shows hardly any structure.

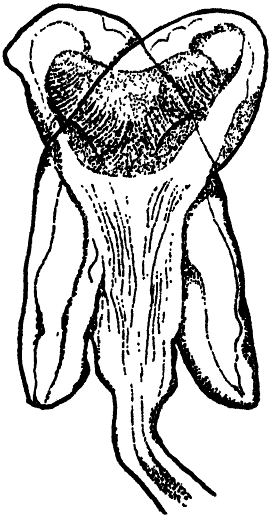


Fig. 350.—*Diagonobothrium asymmetrum*. Head, × 30. (After Shipley and Hornell.)

Type-species :—*Diagonobothrium asymmetrum* Shipley & Hornell, 1906.

Diagonobothrium asymmetrum Shipley & Hornell, 1906. (Fig. 350.)

From *Ætomylœus maculatus*; Pearl Banks, Ceylon. Hornell.

This species was described from a single specimen, of which only the head and neck were obtained. The head consists of a large terminal sucker and of two lateral, hollow, asymmetrical bothridia. The neck is long. The authors state that "one could not put from one's mind that it (*i. e.*, the head) might be an abnormity, especially as only one species was taken and that without any proglottis."

WORMS OF UNCERTAIN IDENTITY.

(1) **Cestoda** sp. Southwell, 1922.

From *Loris gracilis*; Zoological Gardens, Calcutta. Southwell.

About ten segments of a worm were obtained from the above host; each segment is much broader than long, the maximum breadth being about 2 mm. The genital pores are irregularly alternate. The ovary is central, anterior. and fan-shaped, the testes being posterior and extending across the segment. The cirrus is unarmed. The eggs are round and measure 35 μ; they are not in capsules. They have a double covering and contain a hexacanth embryo, but no pyriform apparatus. Owing to lack of material and absence of a head, it is impossible to say to which genus the specimens belong.

(2) **Cestoda** sp. Southwell, 1922.

From *Sterna fluviatilus*; Zoological Gardens, Calcutta. Southwell.

Fragments of a tapeworm which it was impossible to relegate to any particular genus have been recorded from the above host.

(3) **Cestoda** sp. Meggitt, 1926.

From *Corvus splendens insolens*; Rangoon. Meggitt.

Meggitt records an unidentified larval form from the above host.

(4) Moghe (1926) recorded undetermined species of cestodes from (1) the hawk cuckoo, (2) the argus pheasant, (3) the peacock pheasant (two species), and (4) also tapeworm cysts from the mesentery of a rat snake.

(5) Cysticerci have been recorded by Shipley (1903) from *Cervus axis* in Ceylon, but the species is unknown.

CLASSIFIED LIST OF CESTODES FROM INDIA WITH THEIR HOSTS.

Order I. CESTODARIA Monticelli, 1892.

Family I. CARYOPHYLLÆIDÆ Leuckart (quoted by Claus, 1885).

Genus CARYOPHYLLÆUS Mueller, 1787.

Parasite.	Host.
Caryophyllœus indicus Moghe, 1925..	*Clarias batrachus.*

Family II. AMPHILINIDÆ Claus, 1889.

Genus AMPHILINA Wagener, 1858.

1. *Amphilina magna* Southwell, 1915.	*Diagramma crassispinum.*
2. *Amphilina paragonopora* Woodland, 1921.	*Macrones aor, M. seenghala, Bagarius yarrelli* (=*Pimelodus bagarius*).

Order II. EUCESTODA, nov.

Superfamily I. DIBOTHRIOCEPHALOIDEA Stiles, 1906.

Family I. DIBOTHRIOCEPHALIDÆ Lühe, 1899.

Subfamily 1. *DIBOTHRIOCEPHALINÆ* Lühe, 1899.

Genus I. DIBOTHRIOCEPHALUS Lühe, 1899.

1. *Dibothriocephalus felis* (Creplin, 1825).	*Felis tigris, F. pardus.*
2. *Dibothriocephalus reptans* (Diesing, 1850).	*Tropidonotus* sp.
3. *Dibothriocephalus ranarum* (Gastaldi, 1854).	*Rana tigrina* (larval forms).
4. *Dibothriocephalus* sp. Moghe, 1926.	*Felis bengalensis.*
5. *Dibothriocephalus* sp. Southwell, 1922.	Black leopard (? *Felis melas*).
6. *Dibothriocephalus* sp. Southwell, 1922.	*Paradoxurus grayi.*

Genus II. BOTHRIDIUM Blainville, 1824.

1. *Bothridium pithonis* Blainville, 1824.	*Python reticularis, P. molurus, Felis tigris* (probably an accidental host).
2. *Bothridium* sp. Moghe, 1926......	Rock snake (*Python* sp.).

Genus III. DUTHIERSIA Perrier, 1873.

Parasite.	Host.
Duthiersia fimbriata (Diesing, 1850) ..	*Varanus bengalensis, V. exacanthematicus, V.* sp.

Group *SPARGANUM* Diesing, 1855.

Sparganum sp. 1 Meggitt, 1924	*Herpestes albopunctatus* (? *auropunctatus*), *Dichoceros bicornis.*

Subfamily 2. *LIGULINÆ* Monticelli & Crety, 1891.

Genus LIGULA Bloch, 1782.

Ligula intestinalis (Linnæus, 1758) ..	Larval forms from *Labeo calbasu, L. rohita, Nemachilus rupicola.*
Ligula sp. Moghe, 1926	*Rasbora daniconius.*

Family II. TRIÆNOPHORIDÆ Nybelin, 1920.

Genus ANCISTROCEPHALUS Lühe, 1899.

Ancistrocephalus sp. Southwell, 1913.	*Ophiocephalus striatus, Labeo rohita.*

Family III. PTYCHOBOTHRIIDÆ Lühe, 1902.

Genus BOTHRIOCEPHALUS Rudolphi, 1808.

Bothriocephalus pycnomerus Woodland, 1924.	*Ophiocephalus marulius.*
Bothriocephalus histiophorus Shipley, 1901.	*Histiophorus* sp.

Superfamily II. TETRARHYNCHOIDEA, nov.

Family TETRARHYNCHIDÆ Cobbold, 1864.

Genus I. TETRARHYNCHUS Rudolphi, 1809.

(*a*) Adult worms.

Tetrarhynchus perideræus Shipley & Hornell, 1906.	*Carcharias gangeticus, Ginglymostoma concolor.* Larvæ in *Balistes stellatus, B. mitis.*
Tetrarhynchus equidentatus Shipley & Hornell, 1906.	*Dasybatus walga.*
Tetrarhynchus herdmani Shipley & Hornell, 1906.	*Dasybatus walga, Rhynchobatus djiddensis.*
Tetrarhynchus shipleyi Southwell, 1929.	*Ginglymostoma concolor.*
Tetrarhynchus ceylonicus Southwell, 1929.	*Ginglymostoma concolor.*
Tetrarhynchus matheri Southwell, 1929.	*Ginglymostoma concolor.* Larvæ in *Balistes* sp.

(*b*) Larval forms.

Parasite.	Host.
Tetrarhynchus balistidis Shipley & Hornell, 1904.	*Balistes mitis*, *B. stellatus*.
Tetrarhynchus pearsoni Southwell, 1929.	*Cybium guttatum*.
Tetrarhynchus sp. Shipley & Hornell, 1906.	*Balistes mitis*.

Species inquirenda.

Tetrarhynchus minimus Linstow, 1904.	*Tæniura melanospila*.

Genus II. TENTACULARIA Bosc, 1797.

(*a*) Adult worms.

Tentacularia minuta (van Ben., 1858).	*Carcharias* sp., *Rhina halavi*.
Tentacularia longispina (Linton, 1890).	*Dasybatus walga*.
Tentacularia macrocephala (Shipley & Hornell, 1906).	*Dasybatus walga*, *D. kuhli*, *Rhynchobatus djiddensis*.
Tentacularia macropora (Shipley & Hornell, 1906).	*Dasybatus uarnak*, *Stegostoma tigrinum*, *Galeocerdo arcticus*, *Dasybatus* sp.
Tentacularia ætobatidis (Shipley & Hornell, 1906).	*Stoasodon narinari*.
Tentacularia rhynchobatidis (Shipley & Hornell, 1906).	*Rhynchobatus djiddensis*. Larvæ in *Balistes stellatus*.
Tentacularia gangeticus (Shipley & Hornell, 1906).	*Carcharias gangeticus*.
Tentacularia carcharidis (Shipley & Hornell, 1906).	*Carcharias melanopterus*.
Tentacularia leucomelana (Shipley & Hornell, 1906).	*Dasybatus sephen*, *D. kuhli*, *Rhynchobatus djiddensis*.
Tentacularia binunca (Linton, 1909).	*Dasybatus* sp., ? *walga*.
Tentacularia spinulifera (Southwell, 1911).	*Rhynchobatus djiddensis*.
Tentacularia rossi (Southwell, 1912).	*Dasybatus kuhli*, *D. walga*, *Rhynchobatus djiddensis*, *Stoasodon narinari*.
Tentacularia ilisha (Southwell & Prashad, 1918).	*Carcharias gangeticus*. Larvæ in *Clupea ilisha*.
Tentacularia johnstonei Southwell, 1929.	*Dasybatus sephen*.
Tentacularia michiæ Southwell, 1929.	*Rhynchobatus djiddensis*, *D. sephen*, *D. kuhli*.
Tentacularia obesa Southwell, 1929 ..	*Dasybatus sephen*.

(*b*) Larval forms.

Parasite.	Host.
Tentacularia pinnæ (Shipley & Hornell, 1904).	*Balistes stellatus*, *B. mitis*, *Pinna* sp.
Tentacularia spiracornuta (Linton, 1907)	*Caranx* sp., *Thynnus* sp.
Tentacularia macfiei Southwell, 1929.	*Cybium guttatum*, *Cossyphus axillaris*, *Trichiurus savala*, *Chorinemus lysan*, *C. toloo*, *Lutjanus argentimaculatus*, *L. gibbus*, *Balistes stellatus*, *B. mitis*, *B.* sp., *Serranus undulosus*, *Psettodes erumei*.
Tentacularia pillersi Southwell, 1929.	*Cossyphus axillaris*, *Lutjanus argentimaculatus*, *Drepane punctata*, *Diagramma* sp., *Serranus undulosus*.

Species inquirendæ.

Tentacularia rubromaculata (Diesing, 1863).	*Dasybatus walga*.
Tentacularia unionifactor (Shipley & Hornell, 1904).	*Rhinoptera javanica*, *Dasybatus* sp., *Ginglymostoma concolor*. Larvæ in the pearl oyster (*Margaritifera vulgaris*).

Genus III. GYMNORHYNCHUS Rudolphi, 1819.

Gymnorhynchus gigas (Cuvier, 1817).	*Dasybatus walga*. Larvæ in *Hemigaleus balfouri*, *Pristis cuspidatus*, *Cybium guttatum*, *Chorinemus toloo*, *Arius gagora*, *Chirocentrus dorab*, *Trichiurus savala*, *Serranus* sp., *Balistes* sp., *Lutjanus* sp., *Clupea ilisha*, *Harpodon nehereus*.
Gymnorhynchus malleus (Linton, 1924).	*Pteroplatea micrura*, *Dasybatus kuhli*.

Genus IV. OTOBOTHRIUM Linton, 1890.

(*a*) Adult worms.

Otobothrium linstowi (Southwell, 1912).	*Pristis cuspidatus*, *Rhynchobatus djiddensis*.

(*b*) Larval forms.

Otobothrium dipsacum Linton, 1897..	*Diagramma crassispinum*, *Balistes mitis*, *Lethrinus ornatus*, *Lutjanus dodecacanthus*, *Serranus undulosus*.
Otobothrium balli Southwell, 1929 ..	*Cybium guttatum*, *Lethrinus ornatus*, *Balistes stellatus*, *Aprion pristipoma*.

Larval forms of uncertain generic position.

Parasite.	Host.
Tetrarhynchus sp. I. Shipley & Hornell, 1906.	*Cybium guttatum.*
Tetrarhynchus sp. II. Shipley & Hornell, 1906.	*Cybium guttatum.*
Tetrarhynchus sp. III. Shipley & Hornell, 1906.	*Chirocentrus dorab, Lutjanus annularis, Diagramma* sp., *Sphyræna commersoni.*
Tetrarhynchus sp. IV. Meggitt, 1927.	*Hurria rhynchops* (snake).
Plerocercoid larva (Southwell & Prashad, 1918).	*Clupea ilisha.*
Plerocercoid larva Southwell, 1921 ..	*Acromitus rabanchatu* (jellyfish).

Superfamily III. PHYLLOBOTHRIOIDEA, nov.

Family I. PHYLLOBOTHRIIDÆ Braun, 1900.

Genus I. PHYLLOBOTHRIUM van Ben., 1850.

1. *Phyllobothrium lactuca* van Ben., 1850.	*Dasybatus kuhli, D. walga, Galeocerdo arcticus.*
2. *Phyllobothrium giganteum* van Ben., 1858.	*Dasybatus walga.*
3. *Phyllobothrium variabile* (Linton, 1889).	*Dasybatus kuhli, D. walga.*
4. *Phyllobothrium foliatum* Linton, 1890.	*Rhynchobatus djiddensis.*
5. *Phyllobothrium minutum* Shipley & Hornell, 1906.	*Carcharias melanopterus.*
6. *Phyllobothrium panjadi* (Shipley & Hornell, 1906).	*Ætomylæus maculatus, Stoasodon narinari.*
7. *Phyllobothrium lintoni* (Southwell, 1912).	*Rhynchobatus djiddensis, Urogymnus asperrimus.*
8. *Phyllobothrium floriforme* (Southwell, 1912).	*Carcharias bleekeri, C.* sp.
9. *Phyllobothrium tumidum* Linton, 1922.	*Hemigaleus balfouri.*
10. *Phyllobothrium dagnalli* Southwell, 1927.	*Rhina ancylostoma, Chiloscyllium indicum, Galeocerdo arcticus.*
11. *Phyllobothrium microsomum* Southwell & Hilmy, 1929.	*Ginglymostoma concolor.*
12. *Phyllobothrium gracile* Wedl., 1855.	*Dasybatus* sp.

Species inquirendæ.

1. *Phyllobothrium pammicrum* Shipley & Hornell, 1906.	*Carcharias melanopterus.*
2. *Phyllobothrium blakei* Shipley & Hornell, 1906.	*Dasybatus kuhli.*

Genus II. ECHENEIBOTHRIUM van Ben., 1850.

Parasite.	Host.
1. *Echeneibothrium minimum* van Ben., 1850.	*Dasybatus walga, D. kuhli, Rhinoptera javanica, Carcharias* sp.
2. *Echeneibothrium tumidulum* (Rud., 1819) van Ben., 1850.	*Dasybatus walga.*
3. *Echeneibothrium flexile* (Linton, 1890).	*Dasybatus walga, D. uarnak.*
4. *Echeneibothrium cancellatum* (Linton, 1890):	*Rhinoptera javanica.*
5. *Echeneibothrium trifidum* Shipley & Hornell, 1906.	*Dasybatus walga.*

Species inquirenda.

Echeneibothrium simplex Shipley & Hornell, 1906.	*Dasybatus walga.*

Genus III. MYZOPHYLLOBOTHRIUM Shipley & Hornell, 1906.

Myzophyllobothrium rubrum Shipley & Hornell, 1906.	*Stoasodon narinari, Ætomylœus maculatus.*

Genus IV. CARPOBOTHRIUM Shipley & Hornell, 1906.

Carpobothrium chiloscyllii Shipley & Hornell, 1906.	*Chiloscyllium indicum, Rhynchobatus djiddensis, Urogymnus asperrimus.*

Genus V. PITHOPHORUS Southwell, 1925.

Pithophorus tetraglobus (Southwell, 1911).	*Rhynchobatus djiddensis.*

Family II. ONCHOBOTHRIIDÆ Braun, 1900.

Genus I. ONCHOBOTHRIUM (Rud., 1819) Blainville, 1828.

Onchobothrium farmeri (Southwell, 1911).	*Dasybatus kuhli.*

Genus II. ACANTHOBOTHRIUM van Ben., 1850.

1. *Acanthobothrium coronatum* (Rud., 1819) van Ben., 1850.	*Dasybatus kuhli, Carcharias* sp., *Urogymnus asperrimus.*
2. *Acanthobothrium uncinatum* (Rud., 1819) van Ben., 1850.	*Dasybatus kuhli, D. walga.*
3. *Acanthobothrium dujardini* van Ben., 1850.	*Dasybatus walga, D. sephen.*
4. *Acanthobothrium herdmani* Southwell, 1912.	*Dasybatus kuhli.*
5. *Acanthobothrium ijimai* Yoshida, 1917.	*Narcine timlei, Chiloscyllium* sp.
6. *Acanthobothrium macracanthum* Southwell, 1925.	*Urogymnus* sp., ? *asperrimus.*

Genus III. CALLIOBOTHRIUM van Ben., 1850.

Parasite.	Host.
1. *Calliobothrium verticillatum* (Rud., 1819) van Ben., 1850.	*Carcharias* sp.
2. *Calliobothrium eschrichti* (van Ben., 1850).	*Dasybatus sephen.*

Genus IV. UNCIBILOCULARIS Southwell, 1925.

1. *Uncibilocularis trygonis* (Shipley & Hornell, 1906).	*Dasybatus sephen, D. walga.*
2. *Uncibilocularis mandleyi* Southwell, 1927.	*Hemigaleus balfouri.*

Genus V. SPINILOCULUS Southwell, 1925.

Spiniloculus mavensis	*Chiloscyllum indicum.*

Genus VI. PLATYBOTHRIUM Linton, 1890.

Platybothrium cervinum Linton, 1890.	*Galeocerdo arcticus.*

Genus VII. PEDIBOTHRIUM Linton, 1909.

1. *Pedibothrium globicephalum* Linton, 1909.	*Pristis cuspidatus.*
2. *Pedibothrium longispine* Linton, 1909.	*Chiloscyllium indicum, Galeocerdo arcticus, Rhina ancylostoma.*
3. *Pedibothrium hutsoni* (Southwell, 1911).	*Ginglymostoma concolor, Galeocerdo arcticus, Rhina ancylostoma.*

Genus VIII. YORKERIA Southwell, 1927.

Yorkeria parva Southwell, 1927	*Chiloscyllium indicum.*

Genus IX. THYSANOCEPHALUM Linton, 1889.

Thysanocephalum crispum (Linton, 1889).	*Stoasodon narinari.*

Larval forms.

Scolex pleuronectis Mueller, 1788	*Sardinella longiceps.*

Superfamily IV. LECANICEPHALOIDEA, nov.

Family I. LECANICEPHALIDÆ Braun, 1900.

Genus I. LECANICEPHALUM Linton, 1890.

Lecanicephalum peltatum Linton, 1890.	*Pristis cuspidatus, Dasybatus kuhli, Pteroplatea micrura.*

Genus II. CEPHALOBOTHRIUM Shipley & Hornell, 1906.

1. *Cephalobothrium œtobatidis* Shipley & Hornell, 1906.	*Stoasodon narinari, Pteroplatea micrura, Dasybatus kuhli.*
2. *Cephalobothrium abruptum* Southwell, 1911.	*Dasybatus kuhli, Pteroplatea micrura.*
3. *Cephalobothrium variabile* Southwell, 1911.	*Pristis cuspidatus, Dasybatus kuhli.*

Genus III. TYLOCEPHALUM Linton, 1890.

Parasite.	Host.
1. *Tylocephalum trygonis* Shipley & Hornell, 1905).	*Dasybatus walga, D.* sp., ? *kuhli.*
2. *Tylocephalum dierama* Shipley & Hornell, 1906.	*Dasybatus kuhli, Rhynchobatus djiddensis, Rhinoptera javanica, Margaritifera vulgaris* (pearl oyster).
3. *Tylocephalum translucens* (Shipley & Hornell, 1906).	*Stoasodon narinari.*
4. *Tylocephalum uarnak* Shipley & Hornell, 1906.	*Dasybatus kuhli, D. walga, D. uarnak.*
5. *Tylocephalum minutum* Southwell, 1925.	*Urogymnus* sp., ? *asperrimus.*
6. *Tylocephalum yorkei* Southwell, 1925.	*Stoasodon narinari.*

Species inquirendæ.

7. *Tylocephalum œtobatidis* (Shipley & Hornell, 1905) Shipley & Hornell, 1906.	*Dasybatus walga, Stoasodon narinari.*
8. *Tylocephalum minus* Jameson, 1912.	*Margaritifera vulgaris* (pearl oyster).

Genus IV. ADELOBOTHRIUM Shipley, 1900.

Adelobothrium œtobatidis Shipley, 1900.	*Rhynchobatus djiddensis.*

Genus V. BALANOBOTHRIUM Hornell, 1912.

1. *Balanobothrium tenax* Hornell, 1912.	*Dasybatus walga, Stegostoma tigrinum.*
2. *Balanobothrium parvum* Southwell, 1925.	*Dasybatus* sp., *Galeocerdo arcticus.*

Genus VI. POLYPOCEPHALUS Braun, 1878.

1. *Polypocephalus radiatus* Braun, 1878.	*Dasybatus uarnak, D. sephen, D. kuhli.*
2. *Polypocephalus pulcher* (Shipley & Hornell, 1906).	*Dasybatus sephen.*

Genus VII. CALYCOBOTHRIUM Southwell, 1911.

Calycobothrium typicum (Southwell, 1911).	*Stoasodon narinari.*

Genus VIII. STAUROBOTHRIUM Shipley & Hornell, 1905.

Staurobothrum œtobatidis Shipley & Hornell, 1905.	*Stoasodon narinari.*

Genera of uncertain systematic position, but possibly belonging to the family Lecanicephalidæ.

Genus I. ENIOCHOBOTHRIUM Shipley & Hornell, 1906.

Parasite.	Host.
Eniochobothrium gracile Shipley & Hornell, 1906.	*Rhinoptera javanica.*

Genus II. DISCOBOTHRIUM van Ben., 1870.

Discobothrium cobraforme (Shipley & Hornell, 1906).	*Stoasodon narinari.*

Superfamily V. PROTEOCEPHALOIDEA, nov.

Family PROTEOCEPHALIDÆ La Rue, 1911.

Genus I. PROTEOCEPHALUS Weinland, 1858.

1. *Proteocephalus shipleyi* (Linstow, 1903).	*Varanus* (*Hydrosaurus*) *salvator.*
2. *Proteocephalus punicus* (Cholod., 1908) Hall, 1910.	*Paradoxurus hermaphroditus* (Malayan palm-civet).
3. *Proteocephalus naiæ* (Beddard, 1913).	*Naia tripudians.*
4. *Proteocephalus monnigi* (Fuhrmann, 1924).	Unidentified snake.
5. *Proteocephalus beddardi* Woodland, 1925.	*Varanus bengalensis.*
6. *Proteocephalus tigrinus* Woodland, 1925.	*Rana tigrina.*
7. *Proteocephalus ritæ* Verma, 1926 .	*Rita rita.*
8. *Proteocephalus woodlandi* Moghe, 1926.	*Calotes versicolor.*
9. *Proteocephalus fima* (Meggitt, 1927).	*Rhabdophis stolatus.*
10. *Proteocephalus fixus* (Meggitt, 1927).	*Rhabdophis stolatus.*
11. *Proteocephalus vitellaris* Verma, 1928.	*Bagarius yarrelli* (=*Pimelodus bagarius*).

Species of uncertain identity.

Proteocephalus sp. Southwell, 1922 ..	*Bungarus cæruleus.*
Proteocephalus sp. Meggitt, 1926 ..	*Bungarus fasciatus.*
Proteocephalus sp. Meggitt, 1927 ..	*Oligodon purpurescens.*

Genus II. GANGESIA Woodland, 1925.

1. *Gangesia bengalensis* (Southwell, 1913).	*Ophiocephalus striatus, Labeo rohita, Wallago attu.*
2. *Gangesia macrones* Woodland, 1924.	*Macrones seenghala.*
3. *Gangesia pseudeutropii* Verma, 1928.	*Pseudeutropius garua* (=*Silurus garua*).

Superfamily VI. TÆNIOIDEA Zwicke, 1841.

Family I. TÆNIIDÆ Ludwig, 1886.

Genus TÆNIA Linnæus, 1758.

Parasite.	Host.
1. *Tænia solium* Linnæus, 1858	Adult: man. Larva (Cysticercus cellulosæ): pig and man.
2. *Tænia saginata* Goeze, 1782	Adult: man. Larva (Cysticercus bovis): cattle.
3. *Tænia hydatigena* Pallas, 1766	Adult: dogs. Larva (Cysticercus tenuicollis): cattle, sheep, goats, and camels; the four-horned antelope (*Tetracercus quadricornis*).
4. *Tænia echinococcus* (Zeder, 1803) Siebold, 1853.	Adult: dogs. Larva (hydatid cysts): cattle, horses, sheep, camels, and elephants.
5. *Tænia pisiformis* Pallas, 1766	Adult: dogs. *Canis aureus*, *Felis tigris*, *F. leo*, *F. pardus*. Larva (Cysticercus pisiformis): not recorded.
6. *Tænia multiceps* Leske, 1780	Adult: dogs, the jackal (*Canis aureus*), ? *Felis pardus*. Larva (Cœnurus cerebralis): sheep, camels, and ? pigs.
7. *Tænia tæniæformis* (Batsch, 1786) Wolff., 1911.	Adult: cats, *Felis viverrina*. Larva (Cysticercus fasciolaris): rats.
8. *Tænia serialis* (Gervais, 1847)	Adult: dogs. Larva (Cœnurus serialis): not recorded.
9. *Tænia ovis* (Cobbold, 1869) Ransom, 1913.	Adult: dogs. Larva (Cysticercus ovis): not recorded.
10. *Tænia retracta* Linstow, 1903	Adult: *Canis eckloni* (? *Vulpes ferrilatus*). Larva: not recorded
11. *Tænia gaigeri* (Hall, 1916)	Adult: dogs. Larva (Cœnurus gaigeri): goats.

Species inquirendæ.

1. *Tænia meander* Linstow, 1903	Adult: Schneider's leaf-nosed bat (*Hipposidernis speoris*). Larva: not recorded.
2. *Tænia* sp. Linstow, 1906	Adult: *Haliastur indus*.
3. *Tænia* sp. Southwell, 1922	Adult: dogs.
4. *Tænia* sp. Southwell, 1922	Adult: *Ursus torquatus*.
5. *Tænia* sp. (cystic form) Meggitt, 1927.	Adult: *Semnopithecus entellus*.

Family II. ANOPLOCEPHALIDÆ Cholodkovsky, 1902.

Subfamily 1. *ANOPLOCEPHALINÆ* Fuhrmann, 1907.

Genus I. ANOPLOCEPHALA E. Blanchard, 1848.

Parasite.	Host.
1. *Anoplocephala perfoliata* (Goeze, 1782).	Horses.
2. *Anoplocephala magna* (Abildgaard, 1789).	Horses and donkeys.
3. *Anoplocephala mamillana* (Méhlis, 1831).	Horses.
4. *Anoplocephala gigantea* (Peters, 1856) R. Blanchard, 1891.	*Rhinoceros unicornis*, *R. sondiacus.*
5. *Anoplocephala manubriata* Railliet, Henry & Bouche, 1914.	*Elephas maximus.*
6. ? *Anoplocephala* sp. Gaiger, 1915..	Dogs.

Genus II. MONIEZIA Blanchard, 1891.

1. *Moniezia expansa* (Rud., 1810) ..	Sheep, goat, ox, and camel; black-buck (*Antilope cervicapra*) ; four-horned antilope (*Tetracercus quadricornis*).
2. *Moniezia benedeni* (Moniez, 1879) Blanchard, 1891.	Sheep.

Genus III. CITTOTÆNIA Riehm, 1881.

Cittotænia pectinata (Goeze, 1782) ..	*Lepus ruficaudatus*, *L. nigricollis* (*Lepus ? hispidus*).

Genus IV. BERTIELLA Stiles & Hassall, 1902.

Bertiella studeri (Blanchard, 1891) Stiles & Hassall, 1902.	*Simia satyrus*, *Hylobates hoolock.*

Genus V. APORINA Fuhrmann, 1902.

Aporina delafondi (Railliet, 1892) Baer, 1927.	Pigeons (*Columba* sp.) ; *Platycercus pennanti.*

Genus VI. PARONIA Diamare, 1900.

Paronia columbæ (Fuhrmann, 1902) Fuhrmann, 1918.	Pigeons.

Subfamily 2. *THYSANOSOMINÆ* Fuhrmann, 1907.

Genus I. STILESIA Railliet, 1893.

1. *Stilesia globipunctata* (Riv. 1894) Railliet, 1893.	Sheep and goats.
2. *Stilesia vittata* Railliet, 1896......	Sheep.

Genus II. AVITELLINA Gough, 1911.

	Parasite.	Host.
1.	*Avitellina centripunctata* (Riv., 1874) (Railliet, 1893) Woodland, 1927.	Goats.
2.	*Avitellina lahorea* Woodland, 1927.	? Sheep or goats.
3.	*Avitellina goughi* Woodland, 1927.	Cattle, sheep, and goats.

Subfamily 3. *LINSTOWINÆ* Fuhrmann, 1907.

Genus I. LINSTOWIA Zschokke, 1899.

Linstowia sp. Southwell, 1922	*Hemidactylus flaviviridis.*

Genus II. OOCHORISTICA Lühe, 1898.

1.	*Oochoristica cryptobothria* (Linstow, 1906) La Rue, 1911.	Tree-snake (*Chrysopelea ornata*).
2.	*Oochoristica agamæ* Baylis, 1919..	*Hemidactylus gleadovii.*
3.	*Oochoristica crassiceps* Baylis, 1920.	*Calotes versicolor.*
4.	*Oochoristica amphisbeteta* Meggitt, 1924.	A mongoose (*Herpestes albopunctatus*) (? *auropunctatus*).
5.	*Oochoristica sigmoides* Moghe, 1926.	*Calotes versicolor.*
6.	*Oochoristica figurata* Meggitt, 1927.	*Crocidura murina.*
7.	*Oochoristica fibrata* Meggitt, 1927.	*Boiga cyaneus.*

Genus III. THYSANOTÆNIA Beddard, 1911.

Thysanotænia incognita Meggitt, 1927.	*Macropus ruficollis.*

Family III. DAVAINEIDÆ Fuhrmann, 1907.

Subfamily 1. *DAVAINEINÆ* Braun, 1900.

Genus I. DAVAINEA Blanchard, 1891.

Davainea proglottina (Davaine, 1860) R. Blanchard, 1891.	The domestic fowl.

Genus II. RAILLIETINA Fuhrmann, 1920.

Subgenus (*a*) **Raillietina** Stiles & Orleman, 1926 (= *Ransomia* Fuhrmann, 1920).

1.	*Raillietina* (*R.*) *tetragona* (Molin, 1858).	The domestic fowl; *Pavo muticus*, *P. cristatus*, *Francolinus vulgaris.*
2.	*Raillietina* (*R.*) *leptosoma* (Dies., 1850).	*Platycercus eximius.*
3.	*Raillietina* (*R.*) *friedbergeri* (Linstow, 1878) Fuhrmann, 1920.	The black-shouldered peacock (*Pavo nigripennis*).
4.	*Raillietina* (*R.*) *celebensis* (Janicki, 1902).	*Nesocia bengalensis.*

Parasite.	Host.
5. *Raillietina* (*R.*) *microscolecina* Fuhrmann, 1909.	A parrot (*Eclectus rosatus*) (=*Lorius roratus*); *Cacatua moluccensis.*
6. *Raillietina* (*R.*) *aruensis* (Fuhr., 1911).	*Lorius lory.*
7. *Raillietina* (*R.*) *cohni* Baczyńska, 1914.	*Pterocles exustus, P. arenarius.*
8. *Raillietina* (*R.*) *spiralis* (Baczyńska, 1914).	Pigeons (*Columba* sp.); *Crocopus phœnicopterus.*
9. *Raillietina* (*R.*) *polychalix* Kotlàn, 1920–21.	*Lorius garrulus.*
10. *Raillietina* (*R.*) *fuhrmanni* (Southwell, 1922).	*Crocopus phœnicopterus, C. phayrei.*
11. *Raillietina* (*R.*) *parviuncinata* Meggitt, 1924.	Ducks.
12. *Raillietina* (*R.*) *torquata* Meggitt, 1924.	Pigeons (*Columba* sp.).
13. *Raillietina* (*R.*) *nagpurensis* Moghe, 1925.	The domestic pigeon.
14. *Raillietina* (*R.*) *quadritesticulata* Moghe, 1925.	The red turtle-dove (*Œnopopelia tranquebarica*).
15. *Raillietina* (*R.*) *flaccida* Meggitt, 1926.	The imperial sand-grouse (*Pterocles orientalis*).
16. *Raillietina* (*R.*) *famosa* Meggitt, 1927.	*Eclectus pectoralis* (=*Lorius pectoralis*).
17. *Raillietina* (*R.*) *flabralis* Meggitt, 1927.	*Dichoceros bicornis.*
18. *Raillietina* (*R.*) *celebensis* var. *paucicapsulata* Meggitt, 1927.	*Rattus norvegicus, Nesocia bengalensis.*
19. *Raillietina* (*R.*) *maplestonei*, n. sp.	A macaw.

Subgenus (*b*) **Paroniella** Fuhrmann, 1920.

1. *Raillietina* (*P.*) *urogalli* (Modeer, 1790) Fuhrmann, 1920.	The partridge-pheasant (*Alectoris grœca chukar*).
2. *Raillietina* (*P.*) *cruciata* (Rud., 1819).	The magpie (*Pica rustica*).
3. *Raillietina* (*P.*) *corvina* (Fuhr., 1905).	*Corvus macrorhynchus, C. splendens, C.* sp.
4. *Raillietina* (*P.*) *ceylonica* (Baczyńska, 1914).	*Crocopus phœnicopterus*; the white-bellied pigeon (*Columba leuconota*); *Pavo cristatus.*
5. *Raillietina* (*P.*) *tragopani* (Southwell, 1922).	A tragopan pheasant.
6. *Raillietina* (*P.*) *facilis* Meggitt, 1926.	*Tragopan satyra.*
7. *Raillietina* (*P.*) *contorta* Zschokke, 1895.	The common Indian pangolin (*Manis pentadactyla*).

Subgenus (*c*) **Skrjabinia** Fuhrman, 1920.

1. *Raillietina* (*S.*) *cesticillus* (Molin, 1858).	The domestic fowl.
2. *Raillietina* (*S.*) *centropi* Southwell, 1922).	The common cacoal (*Centropus rufipennis*).

Subgenus (*d*) **Fuhrmannetta** Stiles & Orleman, 1926 (=*Johnstonia* Fuhr., 1920).

Parasite.	Host.
1. *Raillietina* (*F.*) *echinobothrida* (Mégnin, 1880).	The domestic fowl; the jungle fowl (*Gallus bankiva*); *Gallus ferrugineus.*
2. *Raillietina* (*F.*) *birmanica* Meggitt, 1926.	The domestic fowl.
3. *Raillietina* (*F.*) *pseudoechinobothrida* Meggitt, 1926.	The domestic fowl.
4. *Raillietina* (*F.*) *korkei* Joyeux & Houdemer, 1928.	Pigeons.

Species of RAILLIETINA Fuhrmann, 1920. Subgenus unknown.

1. *Raillietina anatina* (Fuhrmann, 1909).	Pigeons (*Columba* sp.); the green pigeon (*Crocopus phœnicopterus*).
2. *Raillietina reynoldsæ* Meggitt, 1926.	*Corvus splendens insolens.*
3. *Raillietina fatalis* Meggitt, 1927.	*Nesocia bengalensis*, *Rattus norvegicus.*
4. *Raillietina fluxa* Meggitt, 1927	*Rattus norvegicus.*
5. *Raillietina funebris* Meggitt, 1927.	*Rattus norvegicus.*
6. *Raillietina indicus* Meggitt, 1927.	*Nesocia bengalensis.*
7. *Raillietina* sp. Southwell, 1922.	Pigeons (*Columba* sp.).
8. *Raillietina* sp. Southwell, 1922.	Pigeons (*Columba* sp.).
9. *Raillietina* sp. Southwell, 1922.	Crow-pheasant.
10. *Raillietina* sp. Meggitt, 1926.	*Gallus ferrugineus.*
11. *Raillietina* sp. (*? paradisea* Fuhrmann, 1908).	Pigeons.
12. *Raillietina* spp. Moghe, 1926.	The domestic fowl; *Cypselus affinis*; *Turtur cambayensis.*

Genus III. COTUGNIA Diamare, 1893.

1. *Cotugnia digonophora* (Pasquale, 1890).	Ducks, domestic fowl, and Somett's jungle-fowl.
2. *Cotugnia fuhrmanni* Baczyńska, 1914.	*Pavo cristatus.*
3. *Cotugnia brotogerys* Meggitt, 1915.	*Platycercus eximius.*
4. *Cotugnia margareta* Beddard, 1916.	Crows (*Corvus macrorhynchus*); a moonal pheasant (*Lophophorus refulgens*).
5. *Cotugnia fastigata* Meggitt, 1920.	Domestic ducks; a parrot (*? Ptistes coccineopterus*).
6. *Cotugnia cuneata* var. *tenuis* Meggitt, 1924.	Pigeons (*Columba* sp.).
7. *Cotugnia cuneata* var. *nervosa* Meggitt, 1924.	Pigeons (*Columba* sp.); red turtle-dove.
8. *Cotugnia seni* Meggitt, 1926	*Platycercus eximius.*

Subfamily 2. *OPHRYOCOTYLINÆ* Fuhrmann, 1907.

Genus I. OPHRYOCOTYLE Friis, 1870.

Ophryocotyle zeylanica Linstow, 1906.	The Ceylonese hornbill (*Lophoceros gingalensis*).

Family IV. HYMENOLEPIDIDÆ Railliet & Henry, 1909.

Genus I. HYMENOLEPIS Weinland, 1858.

Parasite.	Host.
1. *Hymenolepis diminuta* (Rudolphi, 1819).	Rats.
2. *Hymenolepis lanceolata* (Bloch, 1782) Weinland, 1858.	The black Australian swan (*Chenopis atrata*).
3. *Hymenolepis murina* (Dujardin, 1845) R. Blanchard, 1891.	Rats, man.
4. *Hymenolepis fusa* (Krabbe, 1869) Fuhrmann, 1906.	*Larus brunneicephalus.*
5. *Hymenolepis spinosa* Linstow, 1906.	The painted snipe (*Rostratula capensis*).
6. *Hymenolepis septaria* Linstow, 1906.	*Upupa ceylonensis.*
7. *Hymenolepis clausa* Linstow, 1906.	The whistling teal (*Dendrocygna javanica*).
8. *Hymenolepis rugosa* Clerc, 1906, var. *birmanica* Meggitt, 1924.	Pigeons (*Columba* sp.).
9. *Hymenolepis kempi* (Southwell, 1921) Mayhew, 1925.	The little cormorant (*Phalacrocorax niger*).
10. *Hymenolepis farciminosa* (Goeze, 1782).	*Corvus macrorhynchus, Acridotheres tristis, A. albocinctus.*
11. *Hymenolepis gracilis* (Zeder, 1803) Cohn, 1901.	*Crocopus phœnicopterus*; the tufted duck (*Nyroca fuligula*); *Phœnicopterus roseus*; domestic ducks.
12. *Hymenolepis sphenocephala* (Rudolphi, 1809) Fuhrmann, 1906.	Pigeons (*Colomba* sp.).
13. *Hymenolepis coronula* (Dujardin, 1845) Cohn, 1901.	Domestic ducks.
14. *Hymenolepis liguloides* (Gervais, 1847).	The flamingo (*Phœnicopterus roseus*).
15. *Hymenolepis furcata* (Stieda, 1862).	*Crocidura murina.*
16. *Hymenolepis medici* (Stossich, 1890) Fuhrmann, 1906.	*Pelicanus philippensis.*
17. *Hymenolepis megalorchis* (Lühe, 1898).	The flamingo (*Phœnicopterus roseus*).
18. *Hymenolepis simplex* Fuhrmann, 1906.	*Tadorna cornuta.*
19. *Hymenolepis zosteropis* Fuhrmann, 1918.	The white-cheeked bulbul (*Criniger flaveolus*; the green magpie (*Cissa chinensis*); the eastern baya (*Ploceus passerinus*); the crested bunting (*Melophus melanicterus*); the tree-pie (*Dendrocitta* sp.); the golden-backed woodpecker (*Brachypternus aurantius*); the laughing thrush (*Trochalopterum meridionale*); the magpie (*Pica rustica*).
20. *Hymenolepis annandalei* Southwell, 1922.	The black-tailed godwit (*Limosa belgica*).

Parasite.	Host.
21. *Hymenolepis rustica* Meggitt, 1926.	The domestic fowl.
22. *Hymenolepis ficticia* Meggitt, 1927.	The pelican.
23. *Hymenolepis minutissima* Meggitt, 1927.	*Crocidura murina.*
24. *Hymenolepis solitaria* Meggitt, 1927.	*Crocidura murina.*
25. *Hymenolepis phalacrocorax* Woodland, 1929.	The large cormorant (*Phalacrocorax carbo*).
26. *Hymenolepis clerci* (Clerc, 1906) Fuhrmann, 1924.	*Passer montanus.*
27. *Hymenolepis capillaroides* Fuhrmann, 1906.	Snipe.

Doubtful species.

Hymenolepis sp. (? *collaris* Batsch, 1786) Fuhrmann, 1908 (= *H. sinuosa* Cohn, 1901).	*Anas pœcilorhyncha.*
Hymenolepis fasciata (Rud., 1810, ? Krabbe, 1869).	Ducks.
Hymenolepis sp. ? (*microcephala* Rud., 1819) Fuhrmann, 1906.	The white stork (*Ciconia alba*).
Hymenolepis sp. Gaiger, 1915	Dogs.
Hymenolepis sp. Southwell, 1916	The domestic fowl (*Dendrocitta* sp.).
Hymenolepis sp. Southwell, 1916	The black Australian swan (*Chenopis atrata*).
Hymenolepis sp. Southwell, 1916	The woodpecker (*Chrysophlegma flavinucha*)
Hymenolepis sp. (? *asymmetrica*) Fuhrmann, 1918.	The red-billed blue magpie (*Urocissa occipitalis*).
Hymenolepis sp. Southwell, 1922	*Emberiza luteola.*
Hymenolepis sp. Southwell, 1922	*Phalacrocorax carbo.*
Hymenolepis sp. Southwell, 1922	A magpie (*Copsychus saularis*).
Hymenolepis sp. Southwell, 1922	Snipe.
Hymenolepis sp. (? *murina* or *diminuta*) Moghe, 1926.	Rats.
Hymenolepis sp. Joyeux & Houdemer, 1928.	Pigeons.

Subgenus **Echinocotyle** Blanchard, 1891.

1. *Echinocotyle rosseteri* Blanchard, 1891.	Domestic ducks.
2. *Echinocotyle uralensis* Clerc, 1902.	Snipe (? *Capella* sp.).

Genus II. FIMBRIARIA Fröhlich, 1802.

Fimbriaria fasciolaris (Pallas, 1781) Wolff., 1900.	*Fuligula cristata*; domestic ducks.

Family V. DILEPIDIDÆ Railliet & Henry, 1909.

Subfamily 1. *DILEPIDINÆ* Fuhrmann, 1907.

Genus I. DILEPIS Weinland, 1858.

Parasite.	Host.
1. *Dilepis campylancristrota* (Wedl, 1855) Fuhrmann, 1908.	Paddy-bird (*Herodias garzetta*); Pond-heron (*Ardeola grayi*).
2. ? *Dilepis* sp.	Tree-pie (*Dendrocitta leucogaster*).

Genus II. LATERIPORUS Fuhrmann, 1907.

Lateriporus spinosus Fuhrmann, 1908	*Ardea purpurea*.

Genus III. CHOANOTÆNIA Railliet, 1896.

1. *Choanotænia infundibuliformis* (Goeze, 1782) Railliet, 1896.	The domestic fowl.
2. *Choanotænia decacantha* Fuhrmann, 1913.	Snipe (*Capella* sp.).
3. *Choanotænia barbara* Meggitt, 1926.	*Passer montanus*.
4. *Choanotænia galbulæ* (Zeder, 1803) Cohn, 1899.	Crow (*Corvus splendens insolens*).
5. *Choanotænia magnicirrosa* Meggitt, 1926.	*Acridotheres tristis*.
6. *Choanotænia* sp. Southwell, 1922..	*Totanus hypoleucos*.

Genus IV. ANOMOTÆNIA Cohn, 1900.

1. *Anomotænia volvulus* (Linstow, 1906) Fuhrmann, 1908.	The yellow-wattled lapwing (*Lobipluvia malabarica*).
2. *Anomotænia acollis* Fuhrmann, 1907.	*Cuculus varius*.
3. *Anomotænia* ? *constricta* (Molin, 1858) Cohn, 1906.	Crows.

Genus V. AMŒBOTÆNIA Cohn, 1899.

Amœbotænia sphenoides (Linstow, 1872).	The domestic fowl (*Gallus ferrugineus*).

Genus VI. PARVIROSTRUM Fuhrmann, 1907.

Parvirostrum magnisomum, n. sp. ..	A vulture.

Genus VII. GRYPORHYNCHUS Nordmann. 1832.

Gryporhynchus pusillus Nordmann, 1832.	A pond-heron (*Ardeola grayi*).

Genus VIII. PENTORCHIS Meggitt, 1927.

Pentorchis arctius Meggitt, 1927	*Ursus malayanus*.

Genus IX. DELTOCERAS Meggitt, 1927.

Parasite.	Host.
Deltoceras ornithius Meggitt, 1927 ..	*Urocissa occipitalis.*

Genus X. CYCLORCHIDA Fuhrmann, 1907.

Cyclorchida omalancristrota (Wedl, 1856), Fuhrmann, 1907.	A spoon-bill (*Platalea* sp.).

Subfamily 2. *DIPYLIDIINÆ* Stiles, 1896.

Genus I. DIPYLIDIUM Leuckart, 1863.

1. *Dipylidium caninum* (Linn., 1758).	Cats and dogs; *Felis viverrina, Hyæna striata*; a Himalayan palm-civet (*Paradoxurus grayi*).
2. *Dipylidium gervaisi* Setti, 1895 ..	*Felis viverrina*; a Malayan palm-civet (*Paradoxurus hermaphroditicus*).
3. *Dipylidium sexcoronatum* Ratz, 1900.	Dogs.
4. *Dipylidium* sp. Gaiger, 1915	Dogs.

Genus II. MONOPYLIDIUM Fuhrmann, 1899.

Monopylidium chandleri Moghe, 1925.	*Sarcogrammus indicus.*

Genus III. SOUTHWELLIA Moghe, 1925.

Southwellia gallinarum (Southwell, 1921).	The domestic fowl.

Genus IV. PROCHOANOTÆNIA Meggitt, 1924.

Prochoanotænia microsoma (Southwell, 1922).	The eastern baya (*Ploceus atrigula*); the crested bunting (*Melophus melanicterus*).

Genus V. MALIKA Woodland, 1929.

Malika œdicnemus Woodland, 1929..	The stone-curlew (*Œdicnemus scolopax*).

Subfamily 3. *PARUTERININÆ* Ransom, 1909.

Genus I. METROLIASTHES Ransom, 1900.

Metroliasthes lucida Ransom, 1900 ..	The domestic fowl.

Genus II. RHABDOMETRA Cholodkovsky, 1906.

1. *Rhabdometra tomica* Cholodkovsky, 1906.	The painted partridge (*Francolinus pictus*).
2. *Rhabdometra dendrocitta* Woodland, 1929.	*Dendrocitta rufa.*

Family VI. MESOCESTOIDIDÆ Fuhrmann, 1907.

Genus I. MESOCESTOIDES Vaillant, 1863.

Parasite.	Host.
1. *Mesocestoides lineatus* (Goeze, 1782) Railliet, 1893.	*Felis tigris* ; dogs.
2. *Mesocestoides mesorchis* Cameron, 1925.	The Tibetan fox (*Vulpes ferrilatus*).

Larval Cestodes.

DITHYRIDIUM Rud., 1819 (=PIESTOCYSTIS Diesing, 1850).

1. Dithyridium sp. Meggitt, 1927 ..	*Rhabdophis stolatus.*
2. Dithyridium sp. Meggitt, 1927 ..	*Dichoceros bicornis.*
3. Dithyridium sp. Meggitt, 1927 ..	*Ophites jara.*
4. Dithyridium sp. Meggitt, 1927 ..	*Bungarus multicinctus.*
5. Dithyridium sp. Meggitt, 1927 ..	*Oligodon purpurescens.*

Family VII. NEMATOTÆNIIDÆ Lühe, 1910.

Genus NEMATOTÆNIA Lühe, 1899.

? *Nematotænia dispar* (Goeze, 1782)..	*Bufo melanostictus*, *B.* sp.

Family VIII. AMABILIIDÆ Fuhrmann, 1908.

Genus AMABILIA Diamare, 1893.

Amabilia lamelligera (Owen, 1832, ? 1835) Diamare, 1893.	The flamingo (*Phœnicopterus roseus*).

Family IX. ACOLEIDÆ Ransom, 1909.

Genus I. DIPLOPOSTHE Jacobi, 1896.

Diploposthe lævis (Bloch, 1782), Jacobi, 1896.	*Netta rufina*; the tufted duck (*Nyroca fuligula*), *N. ferina*, ? *Strepsilas interpres.*

Genus II. GYROCŒLIA Fuhrmann, 1899.

Gyrocœlia paradoxa (Linstow, 1906) Fuhrmann, 1908.	The lesser sand-plover (*Glareola lactea*=*Ægialitis mongolica*).

Family X. TETRABOTHRIIDÆ Linton, 1891.

Genus TETRABOTHRIUS Rudolphi, 1819.

Tetrabothrius erostris (Lönnberg, 1889) Fuhrmann, 1899.	*Sterna bergi.*

Family XI. Diœcocestidæ, nov.

Genus Diœcocestus Fuhrmann, 1900.

Parasite.	Host.
Diœcocestus novæ-guineæ Fuhrmann, 1914.	The little grebe (*Podiceps albipennis*).

Genera of uncertain systematic position.

Genus I. Echinobothrium van Beneden, 1850.

1. *Echinobothrium typus* van Ben., 1850.	*Stoasodon narinari.*
2. *Echinobothrium affine* Diesing, 1863.	*Carcharias* sp., *Rhina halavi.*
3. *Echinobothrium rhinoptera* Shipley & Hornell, 1906.	*Rhinoptera javanica.*
4. *Echinobothrium longicolle* Southwell, 1925.	*Dasybatus kuhli.*

Genus II. Pillersia Southwell, 1927.

Pillersia oweni Southwell, 1927	*Urogymnus asperrimus.*

Genus III. Discocephalum Linton, 1890.

Discocephalum pileatum Linton, 1890.	*Carcharias gangeticus.*

Genus IV. Diagonobothrium Shipley & Hornell, 1906.

Diagonobothrium asymmetrum Shipley & Hornell, 1906.	*Ætomylæus maculatus.*

Worms of uncertain identity.

1. Cestoda sp. Southwell, 1922......	*Loris gracilis.*
2. Cestoda sp. Southwell, 1922......	*Sterna fluviatilis.*
3. Cestoda sp. Meggitt, 1926	*Corvus splendens insolens.*
4. Cestoda sp. Moghe, 1926	Unidentified snake.
5. ? Cysticerci Shipley, 1903........	*Cervus axis.*

CLASSIFIED LIST OF CESTODE HOSTS.

PRIMATES.	Man	*Tænia solium, T. saginata,* Cysticercus cellulosæ, *Hymenolepis murina* (=*H. nana*).
	Simia satyrus	*Bertiella studeri.*
	Semnopithecus entellus	*Tænia* sp. (larva).
	Hylobates hoolock	*Bertiella studeri.*
CARNIVORA.	Dogs	*Tænia hydatigena, T. pisiformis, T. ovis, T. multiceps, T. serialis, T. gaigeri, T. echinococcus, Mesocestoides lineatus,* ? *Hymenolepis* sp., *Dipylidium caninum, D. sexcoronatum.*
	Cats	*Tænia tæniæformis, Dipylidium caninum, Dibothriocephalus felis.*
	Felis viverrina	*Tænia tæniæformis, Dipylidium caninum, D. gervaisi.*
	Felis tigris	*Dibothriocephalus felis, Bothridium pithonis, Tænia pisiformis, Mesocestoides lineatus.*
	Felis leo	*Tænia pisiformis.*
	Felis pardus	*Dibothriocephalus felis, Tænia pisiformis.*
	Felis nebulosa	*Dibothriocephalus felis.*
	Felis bengalensis	*Dibothriocephalus* sp.
	Black leopard (*Felis melas.*	*Dibothriocephalus* sp.
	Paradoxurus hermaphroditicus.	*Proteocephalus punicus, Dipylidium gervaisi.*
	Paradoxurus grayi	*Dipylidium caninum, Dibothriocephalus* sp.
	Herpestes auropunctatus.	*Oochoristica amphisbeteta.*
	Herpestes albopunctatus (? *auropunctatus*).	Sparganum sp.
	Hyæna striata	*Dipylidium caninum.*
	Canis sp.	? *Anoplocephala* sp.
	Canis eckloni (? *Vulpes ferrilatus*).	*Tænia retracta.*
	Canis aureus	*Tænia pisiformis, T. multiceps,*
	Vulpes ferrilatus	*Mesocestoides mesorchis.*
	Ursus torquatus	*Tænia* sp.
	Ursus malayanus	*Pentorchis arctius.*
	Paradoxurus hermaphroditus.	*Proteocephalus punicus.*
INSECTIVORA.	*Crocidura murina*	*Oochoristica figurata, Hymenolepis solitaria, H. minutissima.*

CHIROPTERA.	*Hipposiderus speoris* .	*Tænia meander.*
RODENTIA.	*Rattus norvegicus*....	*Raillietina* (*R.*) *celebensis* var. *paucicapsulata, R. fatalis, R. fluxa, R. funebris.*
	Nesocia bengalensis ..	*Raillietina* (*R.*) *celebensis* var. *paucicapsulata, R. fatalis, R. indica.*
	Rats	Cysticercus fasciolaris, *Hymenolepis diminuta, H. murina.*
	Lepus ruficaudatus ..	*Cittotænia pectinata.*
	Lepus nigricollis.....	*Cittotænia pectinata.*
	Lepus ? hispidus	*Cittotænia pectinata.*
UNGULATA.	*Elephas maximus*....	*Anoplocephala manubriata.*
	Equus caballus	*Anoplocephala perfoliata, A. magna, A. mamillana,* Echinococcus (larva)
	Equus hemionus.....	*Anoplocephala magna.*
	Rhinoceros unicornis.	*Anoplocephala gigantea.*
	Rhinoceros sondiacus.	*Anoplocephala gigantea.*
	Ox	*Moniezia expansa, Avitellina goughi,* Cysticercus bovis, Cysticercus tenuicollis, Echinococcus (larva).
	Bos grunniens	*Moniezia* sp.
	Sheep..............	*Moniezia benedeni, Stilesia globipunctata, S. vittata, Avitellina goughi,* Cysticercus tenuicollis, Cœnurus cerebralis, Echinococcus (larva).
	Sheep or goat.......	*Avitellina lahorea.*
	Goat	*Moniezia expansa, Stilesia globipunctata, Avitellina centripunctata, A. goughi,* Cysticercus tenuicollis, Cœnurus gaigeri.
	Antilope cervicapra ..	*Moniezia expansa.*
	Tetracercus quadricornis.	*Moniezia expansa,* Cysticercus tenuicollis.
	Camel	*Moniezia expansa,* Cysticercus tenuicollis, Echinococcus (larva).
	Pig................	Cysticercus cellulosæ.
	? *Sus cristatus*	Cœnurus cerebralis.
EDENTATA.	*Manis pentadactyla*..	*Raillietina* (*P.*) *contorta.*
MARSUPIALS.	*Macropus ruficollis.*	*Thysanotænia incognita.*
BIRDS. Order I.	*Urocissa occipitalis* ..	*Deltoceras ornithius, Hymenolepis* sp. (? *asymmetrica*).
PASSERES.	*Ploceus atrigula*	*Prochoanotænia microsoma.*
	Ploceus passerinus...	*Hymenolepis zosteropis.*
	Passer montanus	*Hymenolepis clerci, Choanotænia barbara.*

BIRDS (*cont.*). **Order I.** **PASSERES** (*cont.*).	*Dendrocitta leucogaster*	*Dilepis* sp.
	Dendrocitta rufa.....	*Rhabdometra dendrocitta.*
	Dendrocitta spp......	*Hymenolepis zosteropis, Hymenolepis* sp.
	Corvus splendens insolens.	*Choanotænia galbulæ, Raillietina reynoldsæ.*
	Corvus splendens	*Raillietina* (*P.*) *corvina.*
	Corvus macrorhynchus	*Hymenolepis farciminosa, Raillietina* (*P.*) *corvina, Cotugnia margareta.*
	Corvus sp...........	*Raillietina* (*P.*) *corvina.*
	Finch..............	*Choanotænia barbara.*
	Acridotheres tristis...	*Choanotænia magnicirrosa, Hymenolepis farciminosa.*
	Acridotheres albocinctus.	*Hymenolepis farciminosa.*
	Crow	*Anomotænia ? constricta.*
	Criniger flaveolus....	*Hymenolepis zosteropis.*
	Cissa chinensis......	*Hymenolepis zosteropis.*
	Trocalopterum meridionale.	*Hymenolepis zosteropis.*
	Pica rustica	*Hymenolepis sphenocephala, Raillietina* (*P.*) *cruciata.*
	Copsychus saularis...	*Hymenolepis* sp.
	Emberiza luteola.....	*Hymenolepis* sp.
	Cypselus affinis	*Raillietina* sp.
Order II. **CORACIIFORMES.**	*Dichoceros bicornis* ..	Sparganum sp.
	Dichoceros bicornis...	Dithyridium sp. II., *Raillietina* (*R.*) *flabralis.*
	Cuculus varius......	*Anomotænia acollis.*
	Brachypternus aurantius.	*Hymenolepis zosteropis.*
	Upupa ceylonensis...	*Hymenolepis septaria.*
	Chrysophlegma flavinucha.	*Hymenolepis* sp.
	Centropus rufipennis.	*Raillietina* (*S.*) *centropi.*
	Lophoceros gingalensis	*Ophryocotyle zeylanica.*
Order III. **ACCIPITRES.**	*Haliastur indus*......	*Tænia* sp.
	Vulture	*Parvirostrum magnisomum.*
Order IV. **COLUMBÆ.**	Pigeon.............	*Hymenolepis* sp., *Raillietina* (*R.*) *spiralis, Raillietina* (*R.*) *nagpurensis, Raillietina* (*F.*) *korkei.*
	Columba leuconota ..	*Raillietina* (*P.*) *ceylonica.*
	Columba spp........	*Aporina delafondi, Paronia columbæ, Hymenolepis sphenocephala, H. rugosa, Raillietina anatina, Raillietina* sp., *Raillietina* sp. (? *paradisea*), *Raillietina* (*R.*) *torquata, Cotugnia cuneata* var. *tenuis, C. cuneata* var. *nervosa.*

BIRDS (*cont.*). Order IV. COLUMBÆ (*cont.*).	*Crocopus phœnicopterus.*	*Hymenolepis gracilis, Raillietina* (*R.*) *spiralis, Raillietina* (*R.*) *fuhrmanni, Raillietina* (*P.*) *ceylonica, R. anatina.*
	Crocopus phayrei	*Raillietina* (*R.*) *fuhrmanni.*
	Œnopopelia tranquebarica.	*Raillietina* (*R.*) *quadritesticulata.*
	Turtur cambayensis	*Raillietina* sp.
Order V.	*Platycercus pennanti*	*Aporina delafondi.*
PSITTACIFORMES.	*Platycercus eximius*	*Raillietina* (*R.*) *leptosoma, Cotugnia brotogerys, C. seni.*
	Eclectus rosatus (=*Lorius roratus*).	*Raillietina* (*R.*) *microscolecina.*
	Eclectus pectoralis (=*Lorius pectoralis*).	*Raillietina* (*R.*) *famosa.*
	Cacatua moluccensis	*Raillietina* (*R.*) *microscolecina.*
	Lorius lory	*Raillietina* (*R.*) *aruensis.*
	Lorius garrulus	*Raillietina* (*R.*) *polychalix.*
	Ptistes coccineopterus	*Cotugnia fastigata.*
	A macaw	*Raillietina* (*R.*) *maplestonei*, n. sp.
Order VI.	*Pterocles exustus*	*Raillietina* (*R.*) *cohni.*
PTEROCLETES.	*Pterocles arenarius*	*Raillietina* (*R.*) *cohni.*
	Pterocles orientalis	*Raillietina* (*R.*) *flaccida.*
Order VII. GALLINÆ.	Domestic fowl	*Choanotænia infundibuliformis, Hymenolepis rustica, Southwellia gallinarum, Metroliasthes lucida, Raillietina* (*R.*) *tetragona, Amœbotænia sphenoides, Davainea proglottina, Raillietina* (*S.*) *cesticillus, R.* (*F.*) *echinobothrida, R.* (*F.*) *birmanica, R.* (*F.*) *pseudoechinobothrida, Cotugnia digonophora.*
	Gallus ferrugineus	*Amœbotænia sphenoides, Raillietina* (*F.*) *echinobothrida, Raillietina* sp.
	Gallus sonnerati	*Raillietina* (*S.*) *cesticillus.*
	Gallus bankiva	*Raillietina* (*F.*) *echinobothrida.*
	Gallus sp.	*Hymenolepis* sp.
	Francolinus pictus	*Rhabdometra tomica.*
	Francolinus vulgaris	*Raillietina* (*R.*) *tetragona.*
	Pavo muticus	*Raillietina* (*R.*) *tetragona.*
	Pavo cristatus	*Raillietina* (*R.*) *tetragona, R.* (*P.*) *ceylonica, Cotugnia fuhrmanni.*
	Pavo nigripennis	*Raillietina* (*R.*) *friedbergeri.*
	Alectoris græca	*Raillietina* (*P.*) *urogalli.*
	Crow pheasant	*Raillietina* sp.
	Tragopan sp.	*Raillietina* (*P.*) *tragopani.*
	Tragopan satyra	*Raillietina* (*P.*) *facilis.*
	Somett's jungle fowl.	*Cotugnia digonophora.*
	Lophophorus refulgens	*Cotugnia margareta.*

BIRDS (*cont.*). Order VIII. GRALLÆ.	*Rostratula capensis*	*Hymenolepis spinosa.*
Order IX. CHARADRIIFORMES.	*Sarcogrammus indicus.*	*Monopylidium chandleri.*
	Snipe (*Capella* sp.)	*Hymenolepis capillaroides, Echinocotyle uralensis, Choanotænia decacantha.*
	Snipe	*Hymenolepis* sp.
	Totanus hypoleucus	*Choanotænia* sp.
	Lobipluvia malabarica.	*Anomotænia volvulus.*
	Limosa belgica	*Hymenolepis annandalei.*
	Larus brunneicephalus	*Hymenolepis fusa.*
	Œdicnemus scolopax	*Malika œdicnemus.*
	? Strepsilas interpres	*Diploposthe lævis.*
	Glareola lactea (=*Ægialitis mongolica*).	*Gyrocœlia paradoxa.*
	Sterna bergi	*Tetrabothrius erostris.*
Order X. STEGANOPODES.	*Pelicanus philippensis.*	*Hymenolepis medici.*
	Pelican	*Hymenolepis ficticia.*
	Phalacrocorax niger	*Hymenolepis kempi.*
	Phalacrocorax carbo	*Hymenolepis* sp., *Hymenolepis phalacrocorax.*
Order XI. HERODIONES.	*Platalea* sp.	*Cyclorchida omalancristrota.*
	Herodias garzetta	*Dilepis campylancristrota.*
	Ardeola grayi	*Dilepis campylancristrota, Gryporhynchus pusillus.*
	Ardea purpurea	*Lateriporus spinosus.*
	Ciconia alba	*Hymenolepis ? microcephala.*
Order XII. PHŒNICOPTERI.	*Phœnicopterus roseus.*	*Hymenolepis liguloides, H. megalorchis, H. gracilis, Amabilia lamelligera.*
Order XIII. ANSERES.	Domestic ducks	*Echinocotyle rosseteri, Fimbriaria fasciolaris, Hymenolepis sphenocephala, H. coronula, H. ? fasciata, H. gracilis, Raillietina* (*R.*) *parviuncinata, Cotugnia digonophora, C. fastigata.*
	Fuligula cristata	*Fimbriaria fasciolaris.*
	Tadorna cornuta	*Hymenolepis simplex.*
	Anas pœcilorhynchus.	*Hymenolepis* sp. (? *collaris*).
	Chenopis atrata	*Hymenolepis lanceolata, Hymenolepis* sp.
	Dendrocygnia javanica	*Hymenolepis clausa.*
	Nyroca fuligula	*Hymenolepis gracilis, Diplosposthe lævis.*
	Nyroca baeri	*Diplosposthe lævis.*
	Nyroca ferina	*Diplosposthe lævis.*
	Netta rufina	*Diplosposthe lævis.*
Order XIV. PYGOPODES.	*Podiceps albipennis*	*Diœcocestus novæ-guineæ.*

REPTILES. SQUAMATA.	*Hemidactylus flaviviridis.*	*Linstowia* sp.
	Hemidactylus gleadovii	*Oochoristica agamæ.*
	Calotes versicolor	*Oochoristica crassiceps, O. sigmoides, Proteocephalus woodlandi.*
	Chrysopelea ornata...	*Oochoristica cryptobothrium.*
	Rhabdophis stolatus ..	Dithyridium sp. I., *Proteocephalus fima, P. fixus.*
	Ophites jara	Dithyridium sp. III.
	Bungarus multicinctus	Dithyridium sp. IV.
	Bungarus cæruleus ..	*Proteocephalus* sp.
	Bungarus fasciatus ..	*Proteocephalus* sp.
	Oligodon purpurescens	Dithyridium sp. V., *Proteocephalus* sp.
	Boiga cyaneus.......	*Oochoristica fibrata.*
	Python reticularis....	*Bothridium pithonis.*
	Python molurus	*Bothridium pithonis.*
	Tropidonotus sp.	*Dibothriocephalus reptans.*
	Varanus bengalensis..	*Duthiersia fimbriata, Proteocephalus beddardi.*
	Varanus exacanthematicus.	*Duthiersia fimbriata.*
	Varanus salvator	*Proteocephalus shipleyi.*
	Varanus sp.	*Duthiersia fimbriata.*
	Naia tripudians	*Proteocephalus naiæ.*
	Hurria rhynchops....	*Tetrarhynchus* sp. IV.
	Unidentified snake ..	*Proteocephalus monnigi.*
AMPHIBIANS. ECAUDATA.	*Rana tigrina*........	*Dibothriocephalus ranarum, Proteocephalus tigrinus.*
	Bufo melanostictus...	? *Nematotænia dispar.*
FISHES. CARCHARIIDÆ.	*Carcharias gangeticus*	*Tentacularia gangeticus, T. ilisha, Tetrarhynchus perideræus, Discocephalum pileatum.*
	Carcharias melanopterus.	*Tentacularia carcharidis, Phyllobothrium minutum, P. pammicrum.*
	Carcharias bleekeri...	*Phyllobothrium floriforme.*
	Carcharias spp.	*Tentacularia minuta, Acanthobothrium coronatum, Calliobothrium verticillatum, Echeneibothrium minimum, Phyllobothrium floriforme, Echinobothrium affine.*
	Hemigaleus balfouri..	*Gymnorhynchus gigas, Uncibilocularis mandleyi, Phyllobothrium tumidum.*
	Galeocerdo arcticus...	*Tentacularia macropora, Platybothrium cervinum, Pedibothrium longispine, P. hutsoni, Phyllobothrium lactuca, P. dagnalli, Balanobothrium parvum.*

FISHES (*cont.*).		
SCYLLIIDÆ.	*Ginglymostoma concolor.*	*Tentacularia unionifactor, Tetrarhynchus perideræus, T. shipleyi, T. ceylonicus, T. matheri, Pedibothrium hutsoni, Phyllobothrium microsomum.*
	Stegostoma tigrinum..	*Tentacularia macropora, Balanobothrium tenax.*
	Chiloscyllium indicum	*Pedibothrium longispine, Yorkeria parva, Phyllobothrium dagnalli, Carpobothrium chiloscyllii, Spiniloculus mavensis.*
	Chiloscyllium sp.....	*Acanthobothrium ijimai.*
PRISTIDÆ.	*Pristis cuspidatus* ...	*Gymnorhynchus gigas, Otobothrium linstowi, Pedibothrium globicephalum, Lecanicephalum peltatum, Cephalobothrium variabile.*
RHINOBATIDÆ.	*Rhynchobatus djiddensis.*	*Tentacularia macrocephala, T. rhynchobatidis, T. leucomelana, T. spinulifera, T. rossi, T. michiæ, Tetrarhynchus herdmani, Otobothrium linstowi, Adelobothrium ætobatidis, Carpobothrium chiloscyllii, Pithophorus tetraglobus, Phyllobothrium foliatum, P. lintoni, Tylocephalum dierama.*
	Rhina ancylostoma...	*Pedibothrium longispine, P. hutsoni, Phyllobothrium dagnalli.*
	Rhina halavi........	*Tentacularia minuta, Echinobothrium affine.*
TORPEDINIDÆ.	*Narcine timlei*	*Acanthobothrium ijimai.*
DASYBATIDÆ.	*Urogymnus asperrimus.*	*Acanthobothrium coronatum, Phyllobothrium lintoni, Carpobothrium chiloscyllii, Pillersia oweni.*
	Urogymnus sp. ?	*Acanthobothrium macracanthum, Tylocephalum minutum.*
	Dasybatus kuhli	*Tentacularia macrocephala, T. leucomelana, T. rossi, T. michiæ, Gymnorhynchus malleus, Onchobothrium farmeri, Acanthobothrium coronatum, A. uncinatum, A. herdmani, Phyllobothrium lactuca, P. blakei, P. variabile, Echeneibothrium minimum, Lecanicephalum peltatum, Cephalobothrium ætobatidis, C. abruptum, C. variabile, Tylocephalum dierama, T. uarnak, Polypocephalus radiatus, Echinobothrium longicolle.*
	Dasybatus sp. (? *kuhli*)	*Tylocephalum trygonis.*

FISHES (*cont.*). **Dasybatidæ** (*cont.*).	*Dasybatus sephen*	*Tentacularia leucomelana, T. johnstonei, T. michiæ, T. obesa, Acanthobothrium dujardini, Calliobothrium eschrichti, Uncibilocularis trygonis, Polypocephalus radiatus, P. pulcher.*
	Dasybatus uarnak	*Tentacularia macropora, Echeneibothrium flexile, Tylocephalum uarnak, Polypocephalus radiatus.*
	Dasybatus walga	*Tentacularia longispina, T. macrocephala, T. rossi, T. rubromaculata, Tetrarhynchus equidentatus, T. herdmani, Gymnorhynchus gigas, Acanthobothrium uncinatum, A. dujardini, Uncibilocularis trygonis, Phyllobothrium lactuca, P. giganteum, P. variabile, Echeneibothrium minimum, E. flexile, E. trifidum, E. simplex, E. tumidulum, Tylocephalum trygonis, T. uarnak, T. ætobatidis, Balanobothrium tenax.*
	Dasybatus sp. (? *walga*)	*Tentacularia binunca, T. unionifactor.*
	Dasybatus sp.	*Tentacularia macropora, Balanobothrium parvum, Phyllobothrium gracile.*
	Tæniura melanospila.	*Tetrarhynchus minimus.*
	Pteroplatea micrura	*Gymnorhynchus malleus, Lecanicephalum peltatum, Cephalobothrium ætobatidis, C. abruptum.*
Myliobatidæ.	*Ætomylæus maculatus*	*Phyllobothrium panjadi, Myzophyllobothrium rubrum, Diagonobothrium asymmetrum.*
	Rhinoptera javanica	*Tentacularia unionifactor, Echeneibothrium minimum, E. cancellatum, Tylocephalum dierama, Eniochobothrium gracile, E. rhinoptera.*
	Stoasodon narinari	*Tentacularia ætobatidis, T. rossi, Thysanocephalum crispum, Phyllobothrium panjadi, Myzophyllobothrium rubrum, Cephalobothrium ætobatidis, Tylocephalum translucens, T. yorkei, T. ætobatidis, Calycobothrium typicum, Staurobothrium ætobatidis, Discobothrium cobraforme, Echinobothrium typus.*
Siluridæ.	*Clarias batrachus*	*Caryophyllæus indicus.*
	Macrones aor	*Amphilina paragonopora.*

FISHES (*cont.*).		
SILURIDÆ (*cont.*).	*Macrones seenghala*	*Amphilina paragonopora*, *Gangesia macrones*.
	Rita rita	*Proteocephalus ritæ*.
	Arius gagora	*Gymnorhynchus gigas*.
	Bargarius yarrelli	*Proteocephalus vitellaris*, *Amphilina paragonopora*.
	Wallago attu	*Gangesia bengalensis*.
	Pseudeutropius garua	*Gangesia pseudeutropii*.
OPHIOCEPHALIDÆ.	*Ophiocephalus striatus*	*Ancistrocephalus* sp., *Gangesia bengalensis*.
	Ophiocephalus marulius	*Bothriocephalus pycnomerus*.
CYPRINIDÆ.	*Labeo rohita*	*Ligula intestinalis*, *Ancistrocephalus* sp., *Gangesia bengalensis*.
	Labeo calbasu	*Ligula intestinalis*.
	Nemachilus rupicola	*Ligula intestinalis*.
	Rabora daniconius	*Ligula* sp.
CHIROCENTRIDÆ.	*Chirocentrus dorab*	*Gymnorhynchus gigas*, *Tetrarhynchus* sp. III.
CLUPEIDÆ.	*Sardinella longiceps*	Scolex pleuronectis.
	Clupea ilisha	*Tentacularia ilisha*, *Gymnorhynchus gigas*, Plerocercoid larvæ.
SCOPELIDÆ.	*Harpodon nehereus*	*Gymnorhynchus gigas*.
PERCIDÆ.	*Serranus undulosus*	*Tentacularia macfiei*, *T. pillersi*, *Otobothrium dipsacum*.
	Serranus sp.	*Gymnorhynchus gigas*.
	Lutjanus argentimaculatus.	*Tentacularia macfiei*, *T. pillersi*.
	Lutjanus gibbus	*Tentacularia macfiei*.
	Lutjanus dodecacanthus.	*Otobothrium dipsacum*.
	Lutjanus annularis	*Tetrarhynchus* sp. III.
	Lutjanus sp.	*Gymnorhynchus gigas*.
	Aprion pristipoma	*Otobothrium balli*.
	Diagramma crassispinum.	*Otobothrium dipsacum*, *Amphilina magna*.
	Diagramma sp.	*Tentacularia pillersi*, *Tetrarhynchus* sp. III.
	Histiophorus sp.	*Bothriocephalus histiophorus*.
SQUAMIPINNES.	*Drepane punctata*	*Tentacularia pillersi*.
SPARIDÆ.	*Lethrinus ornatus*	*Otobothrium dipsacum*, *O. balli*.
TRICHIURIDÆ.	*Chorinemus lysan*	*Tentacularia macfiei*.
	Chorinemus toloo	*Tentacularia macfiei*, *Gymnorhynchus gigas*.
	Trichurus savala	*Tentacularia macfiei*, *Gymnorhynchus gigas*.

FISHES (*cont.*).

CARANGIDÆ.	*Caranx* sp.	*Tentacularia spiracornuta.*
SCOMBRIDÆ.	*Cybium guttatum*	*Tentacularia macfiei, Tetrarhynchus pearsoni, Gymnorhynchus gigas, Otobothrium balli, Tetrarhynchus* sp. I., *Tetrarhynchus* sp. II.
	Thynnus sp.	*Tentacularia spiracornuta.*
SPHYRÆNIDÆ.	*Sphyræna commersoni.*	*Tetrarhynchus* sp. III.
LABRIDÆ.	*Cossyphus axillaris*	*Tentacularia macfiei.*
PLEURONECTIDÆ.	*Psettodes erumei*	*Tentacularia macfiei.*
SCLERODERMI.	*Balistes stellatus*	*Tentacularia rhynchobatidis, T. pinnæ, T. macfiei, Tetrarhynchus perideræus, T. balistidis, Otobothrium balli.*
	Balistes mitis	*Tentacularia pinnæ, T. macfiei, Tetrarhynchus balistidis, Otobothrium dipsacum, Tetrarhyn-*
	Balistes sp.	*Tetrarhynchus matheri, Gymnorhynchus gigas.*
MOLLUSCA.	*Pinna* sp.	*Tentacularia pinnæ.*
	The pearl oyster (*Margaritifera vulgaris*).	*Tentacularia unionifactor, Tylocephalum dierama, T. minus.*
CŒLENTERATA.	*Acromitus rabanchatu.*	Plerocercoid larvæ.

APPENDIX.

With reference to the names of the birds from which cestodes have been obtained, I have in every case accepted the name given to the host by the collector.

Named birds were frequently received from the Zoological Gardens, Calcutta; in other cases the name of the host was determined by the authorities of the Indian Museum.

Mr. Norman B. Kinnear, of the British Museum, has been good enough to provide the following remarks on these avian identifications:—

Name used in this volume.	Correct name.
Francolinus vulgaris	Indian black partridge, *Francolinus francolinus asiæ*; Assam black partridge, *Francolinus francolinus melanonotus* (may be either).
Pavo nigripennis	A melanic aberration of *Pavo cristatus*.
Pterocles arenarius	Black-bellied or imperial sandgrouse, *Pterocles orientalis*.
Crocopus phœnicopterus	Bengal green pigeon, *Crocopus phœnicopterus phœnicopterus*.
Crocopus phayrei	Ashy-headed green pigeon, *Dendrophassa pompadora phayrei*.
Caccabis chukar	Chukar, *Alectoris græca chukar*.
Pica rustica	Kashmir magpie, *Pica pica bactriana*; Black-rumped magpie, *Pica pica bottanensis*.
Corvus macrorhynchus	*Corvus coronoides levaillanti*, *Corvus coronoides culminatus* (Stuart Baker, Fauna Brit. India).
Corvus splendens	Indian jungle-crow, *Corvus levaillanti levaillanti*; Common Indian house-crow, *Corvus splendens insolens*.
A tragopan pheasant	*Tragopan* sp.
The common caccal (*Centropus rufipennis*)	The common crow-pheasant or coucal, *Centropus sinensis*.
Gallus bankiva	Indian red jungle-fowl, *Gallus gallus murghi* (Indian).
Gallus ferrugineus	Indian red jungle-fowl, *Gallus gallus murghi* (Indian); Burmese red jungle-fowl, *Gallus gallus robinsoni* (Burma).
Crow-pheasant	Common crow-pheasant or coucal, *Centropus sinensis*.
Cypselus affinis	Common Indian house-swift, *Micropus affinis affinis*.
Turtur cambayensis........	The Indian little brown dove, *Streptopelia senegalensis cambaiensis*.
Somett's Jungle-fowl (Sonnerat's).	Grey jungle-fowl, *Gallus sonnerati*.

Name used in this volume.	Correct name.
A moonal pheasant	Impeyan pheasant or monal.
Lophophorus refulgens	*Lophophorus impejanus.*
Red turtle-dove	*Œnopopelia tranquebarica tranquebarica.*
Ceylon hornbill	Ceylon grey hornbill.
Lophoceros gingalensis	*Lophoceros griseus gingalensis.*
Larus brunneicephalus	Indian black-headed gull, *Larus brunnicephalus.*
Rostratula capensis	Painted snipe, *Rostratula capensis.*
Upupa ceylonensis	Ceylon hoopoe, *Upupa epops ceylonensis.*
Whistling teal	Lesser or common whistling teal.
Phalacrocorax pygmæus (=*P. javanicus*).	Little cormorant, *Phalacrocorax niger.*
Acridotheres albocinctus	Collared myna, *Æthiopsar albocinctus.*
Fuligula cristata	*Nyroca fuligula.*
Phœnicopterus roseus	Flamingo, *Phœnicopterus ruber antiquorum.*
Tadorna cornuta	Sheldrake, *Tadorna tadorna.*
White-cheeked bulbul	Indian white-throated bulbul, *Criniger flaveolus*; White-cheeked bulbul, *Molpastes leucogenys.*
Criniger flaveolus	*Criniger tephrogenys flaveolus.*
Ploceus atrigula	Eastern baya, *Ploceus passerinus passerinus.*
Brachypternus aurantius	*Brachypternus benghalensis benghalensis, B. benghalensis dilutus, B. benghalensis puncticollis.*
The laughing-thrush	Blanford's laughing-thrush.
Trochalopterum meridionale.	*Trochalopterum jerdoni meridionale.*
Limosa belgica	*Limosa limosa.*
Pelican	*Pelicanus* sp.
Snipe	Snipe, *Capella* sp. ?
Snipe (*Gallinago* sp.)	Snipe, *Capella* sp. ?
Ciconia alba	*Ciconia ciconia.*
Woodpecker	The large yellow-naped woodpecker, *Chrysophleyma flavinucha.*
Urocissa occipitalis	*Urocissa melanocephala occipitalis.*
Emberiza luteola	Red-headed bunting, *Emberiza icterica.*
Magpie	Indian magpie ; Robin.
Paddy-bird (*Herodias garzetta*).	The little egret, *Egretta garzetta garzetta.*
Pond-heron (*Ardeola grayi*).	Indian pond-heron, or paddy bird, *Ardeola grayi.*
Tree-pie (*Dendrocitta leucogaster*)	Southern tree-pie, *Dendrocitta leucogaster.*
Totanus hypoleucos	Common sandpiper, *Tringa hypoleucos.*
Cuculus varia	Common hawk-cuckoo (Brain-fever bird), *Hierococcyx varius.*
Spoon-bill (*Platalea* sp.)	If from India, Indian spoonbill, *Platalea leucorodia major.*
Sarcogrammus indicus	Indian red-wattled lapwing, *Lobivanellus indicus indicus.*

The stone-curlew (*Œdicnemus scolopax*)	The Indian stone-plover, *Burhinus œdicnemus indicus.*
? *Strepsilas interpres*	Turnstone, *Arenaria interpres.*
The lesser sand-plover	Small Indian pratincole or sand-plover, *Glareola lactea,* or *Cirrepidesmus mongolus atrifrons.*
Sterna bergi	Large crested tern, *Thalasseus bergi.*

Not Indian Birds.

Platycercus eximius	Rosella.
Cacatua moluccensis	Rose-crested cockatoo, *Kakatoë moluccensis.*
Eclectus rosatus	Grand eclectus, *Lorius roratus.*
Lorius lory	Black-capped lory, *Domicella lory.*
Lorius garrulus	Scarlet lory, *Domicella garrulus.*
Lorius pectoralis	Red-sided eclectus, *Lorius pectoralis.*
Chenopis atrata	Black swan.

ADDENDA.

Spiniloculus mavensis Southwell, 1925. (Figs. 351 & 352.)

The writer in 1925 erected a new genus and species for a worm which was presented, stained and mounted, and which was obtained from a ground-shark (*Mustelus* sp.) from Brisbane, Australia.

It was stated in the description of this worm that each bothridium was divided into three loculi by two septa.

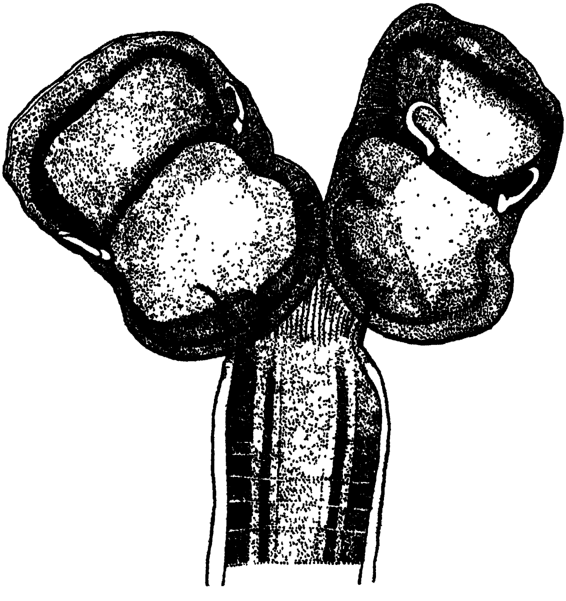


Fig. 351.—*Spiniloculus mavensis.* Head, × 99. Original.

Recently five specimens of this parasite have been obtained from the spiral valve of *Chiloscyllium indicum*, Pearl Banks, Ceylon (Pearson). An examination of these worms shows conclusively that the bothridia are divided into two loculi by a single septum, and not into three loculi, as was stated in the original description. The type-species conveys the impression that there are three loculi, but it is now clear that what was thought to be a septum is, in reality, the point of attachment of the bothridium to the strobila, a fact which serves to emphasize the necessity for examining quantities of material, both mounted and unmounted, before arriving at a diagnosis.

The characters of the genus are therefore amended accordingly :—

Spiniloculus Southwell, 1925. Head with four bothridia, disposed in pairs. Each bothridium is armed with a pair of simple or compound hooks, equal in size, one hook situated near each lateral margin of each septum. Genital pores marginal.

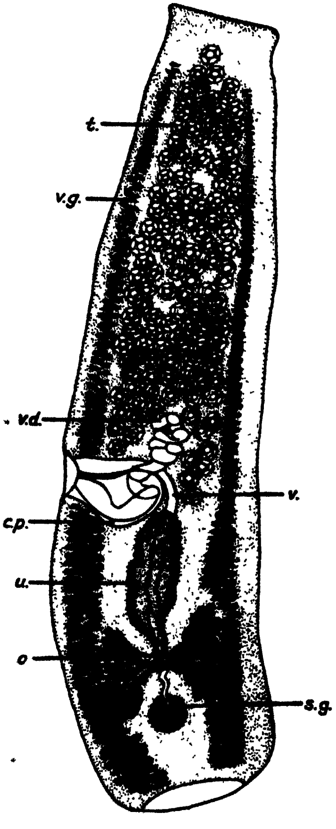


Fig. 352.—*Spiniloculus mavensis.* Mature segment, × 53. (Original.)

The genus differs from *Uncibilocularis* in the disposition of the bothridia and position of the hooks.

The worm measures about 2·5 cm. in length and has a maximum breadth of about 750 μ. It is made up of about 50 segments; the posterior ones, which are not gravid, measure

3 mm. in length and up to 750 μ in breadth. The genital pores are irregularly alternate and are situated a little behind the middle of the lateral margin of the segment. The head measures about 700 μ in length by 800 μ in breadth; it bears four bothridia arranged in pairs, each bothridium being divided into two loculi which are almost equal in size. At the lateral extremity of each septum there is a single undivided hook having the shape of a fish-hook, with the following dimensions :—Outer limb, 58 μ; inner limb, 80 μ; breadth of the hook, about 60 μ.

Accessory suckers are absent and there is no neck.

There are about 180 testes, all of which are situated anterior to the cirrus pouch. When fully developed they are either globular, having a diameter of about 75 μ, or oval, measuring about 110 μ by 70 μ.

The cirrus pouch varies in shape from globular to pyriform, having a diameter of about 60 μ. The cirrus is a little dilated and appears to be armed with a few small spines. A number of coils of the vas deferens lie within the pouch. Outside and anterior to the pouch a short portion of the vas deferens lies coiled in the antero-posterior axis.

The ovary is bilobed, granular, and situated posteriorly; its shape varies according to whether the segment is elongated or not.

From the pore the vagina runs parallel and anterior to the cirrus pouch, and this portion is frequently dilated. At the median extremity of the pouch it turns and runs posteriorly, often disposed in a number of coils, dilating into a small receptaculum seminis, immediately posterior to which it is surrounded by a prominent shell gland.

The vitelline gland consists of a number of acini limited to the lateral margins.

The uterus was rudimentary in all the worms examined, and consisted of a granular mass running in the antero-posterior axis and extending anteriorly as far as the cirrus pouch. Its posterior extremity is blind; the oviduct opens into it a little posterior to the level of the cirrus pouch. Eggs unknown.

Phyllobothrium gracile Wedl, 1855. (Figs. 353 & 354.)

Synonyms:—*Anthobothrium auriculatum* Diesing, 1863.
Anthocephalum gracile Linton, 1890.
Anthobothrium gracile, Linton, 1890.
Phyllobothrium centrurum Southwell, 1925.

From *Dasybatus* sp.; Pearl Banks, Ceylon.

The worms attain a length of about 1·5 cm. and a maximum breadth of about 300 μ; they are very fragile and are composed of about 60 segments, the last one having a length of 2·3 mm.

and a breadth of about 300 μ. The genital pores are situated in the posterior quarter of the lateral margin of the segment, and are irregularly alternate. The head bears four funnel-shaped bothridia each borne on a stout contractile pedicel.

Linton states that each bothridium bears a single supplemental disk and also a marginal row of small loculi. Examination of a number of specimens shows that the former may be present on some bothridia in one strobila and absent on other bothridia in the same strobila. The marginal loculi do, in places, become circular, and appear as minute suckers.

The testes, which number about 60, occupy the entire field anterior to the cirrus pouch, but they do not extend posterior to this organ. The cirrus pouch is very large and almost globular, extending nearly to the middle of the segment, its internal extremity turning posteriorly. It contains many coils of the vas deferens. The cirrus is armed. Internal to the pouch the vas deferens dilates into a seminal vesicle and then continues anteriorly as a much-coiled duct for a distance of about 70 μ.

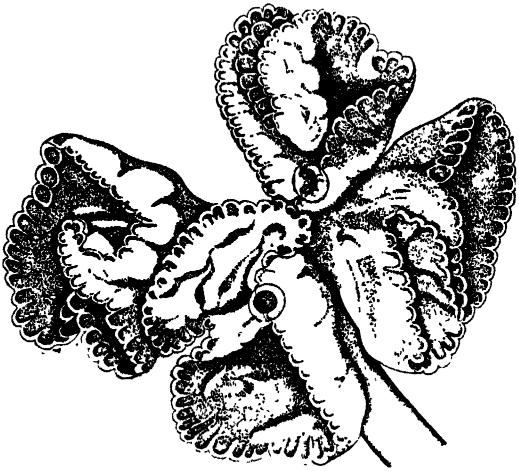


Fig. 353.—*Phyllobothrium gracile.* Head. Two bothridia show accessory suckers; all bothridia show crenulated margins with the formation of numerous minute marginal suckers; × 54. (Original.)

The ovary develops late and is situated in the posterior fifth of the segment. It appears bilobed, each half being laterally placed between the follicles of the vitelline glands, and is thus very difficult to make out. Each wing sends a process towards the middle line; from the junction of these processes the oviduct arises and proceeds posteriorly to join the vagina.

The vagina runs in front of the cirrus pouch and has a diameter of about 10 μ only, including its thick wall. When it has proceeded beyond the median axis it suddenly widens in diameter and curves posteriorly, proceeding in that direction until it reaches the ovary.

The vitelline glands are arranged in two rows along each lateral margin. They increase greatly in size as they proceed posteriorly, and attain their maximum dimensions at the level of the ovary and behind it. These posterior follicles of the vitelline glands can easily be mistaken for the ovary, which latter organ, however, develops much later. The vitelline ducts are very difficult to see in whole mounts. The shell gland (?) is situated posteriorly and is very small. The uterus begins as a coiled canal which becomes sinuous as it proceeds forwards until it reaches the anterior extremity of the segment. Eggs unknown.

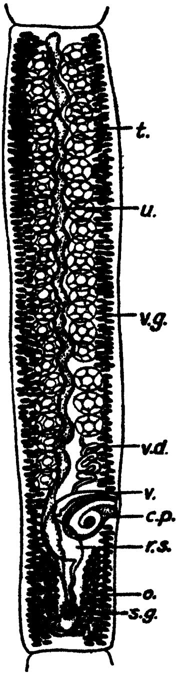


Fig. 354.—*Phyllobothrium gracile.*
Mature segment, × 48. (Original)

Raillietina (Raillietina) maplestonei, sp. n. (Fig. 355.)

From a macaw; Zoological Gardens, Calcutta. Maplestone.

The length of the worm is not known, as the material consisted of a number of fragments, some with heads. It is estimated, however, that it measures from 3 to 4 cm. and has a maximum breadth of 2 mm. All the segments are broader than long; the genital pores are unilateral and situated near the middle of the lateral margin of the segment.

The head has a maximum breadth of 350 μ. The four suckers, each of which has a diameter of 90 μ, are armed with several rows of minute hooks. The number of hooks on the rostellum could not be counted definitely, but it was estimated that there were from 200 to 250; they are arranged in a double row, each hook having a length of about 14 μ.

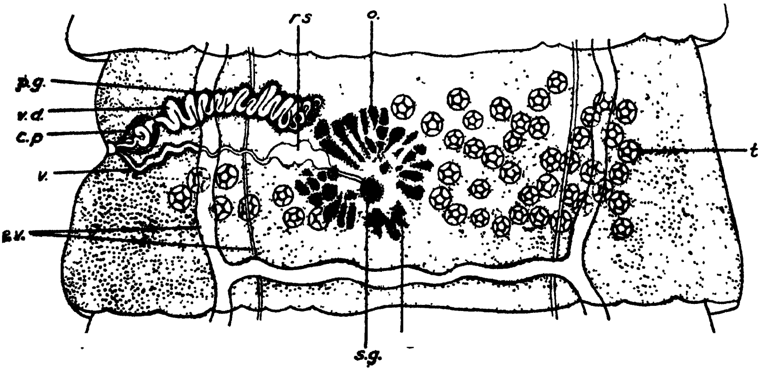


Fig. 355.—*Raillietina maplestonei*, n. sp., × 85. (Original.)

There is a short neck measuring about 750 μ. A portion of the neck and the whole of the head are covered with extremely minute spines.

The excretory, nervous, and muscular systems were not investigated.

Male Genitalia. The male and female pores open separately at the base of a minute cup-shaped genital atrium and the vas deferens is situated in front of the vagina. The cirrus pouch is globular, very small, extending only about one-third the distance to the poral excretory vessel. The vas deferens reaches almost to the middle of the segment and is surrounded throughout its length with a conspicuous granular prostatic gland. There are in all about 48 testes; on the pore side there are about eight, all situated behind the vagina, and most of them lie lateral to the minute internal (? dorsal) excretory vessel. Aporally there are about 40, of which

List of Species of Raillietina *(with their principal characters) which have been recorded from Psittaciformes.*

	leptosoma.	*macroscolecina.*	*microscolecina.*	*cacatuina.*	*aruensis.*	*oligorchida.*	*psittacea.*	*maplestonei*, n. sp.
Length of worm.	160 mm.	60 to 80 mm.	70 to 100 mm.	50 mm.	100 mm.	*7 mm.	100 mm.	30 to 40 mm.
Breadth of worm.	2 mm.	1 mm.	1 mm.	300 μ.	2 mm.	500 μ.	2·3 mm.	1 to 2 mm.
Number of hooks.	*70.	*350.	180.	Not known.	180 to 200.	Not known.	180.	200 to 250.
Size of hooks... ..	11 to 13 μ.	*20 μ.	10 to 13 μ.	*6 μ.	18 μ.	12 to 14 μ.	18 to 20 μ.	13 μ.
Suckers	Armed.	*Unarmed.	Armed.	Armed.	*Unarmed.	Armed.	Armed.	Armed.
Spines on head ...	Not recorded.	Not recorded.	Not recorded.	Not recorded.	Not recorded.	Not recorded.	Not recorded.	Present.
Number of testes.	*50 to 60. Cirrus sac extends to excretory vessel.	About 20.	19 to 24. 9–10 poral; 12–14 aporal. Cirrus sac extends to excretory vessel.	*4 to 5.	20. 14 aporal; 6 poral.	*5 to 6.	*20 to 25. 5-6 poral; 3–4 behind ovary; rest aporal.	About 48 testes. Poral:—2 lateral and 6 median to the minute E.V. Aporal:—13 lateral and 27 median to the minute E.V.
Ovary...............	—	—	—	Figured symmetrically.	—	Figured symmetrically.	—	Markedly asymmetrical.
Uterus	—	—	Capsules situated between two excretory vessels.	—	—	Capsules situated between excretory vessels.	*Capsules situated between excretory vessels.	Capsules extend lateral to excretory vessels.
Host	Parakeet (*Psittacus erithicus*).	*Lorius garrulus.* *Pionopsittacus pileatus.*	*Eclectus rosatus*, *E. pectoralis aruensis.*	*Cacatua galarita.*	*Trichoglossus cyanogrammus nigrogularis.*	*Eclectus pectoralis aruensis.*	*Cacatua triton macrolopha.*	Macaw.
Locality............	South America.	Brazil.	Aru Is.	Australia.	Aru Is.	Aru Is.	Aru Is.	Calcutta, (?) imported.

* Species with features which differ from *R. maplestonei.*

about 13 are situated immediately lateral to the minute aporal (? dorsal) excretory vessel, the remainder lying median to it. No seminal vesicle was observed.

Female Genitalia. The ovary is placed asymmetrically, quite markedly on the pore side ; it is fan-shaped and composed of numerous cylindrical bodies. Its axis forms an angle of about 45° to the transverse axis of the segment. A conspicuous shell gland lies at the base of the ovary. Immediately behind the latter organ is a somewhat globular vitelline gland presenting a refractile granular appearance. The poral extremity of the vagina is definitely glandular. Near the ovary the vagina dilates into a receptaculum seminis.

The egg capsules extend laterally beyond the excretory vessels on both sides ; each contains from three to seven eggs.

I have been unable to determine either the species or the genus of the host from which this worm was taken. It appears, however, that macaws are limited in distribution to South America, and one must assume that the bird was imported to the Zoological Gardens in Calcutta.

The table on p. 255 gives the principal characters of species of *Raillietina* which have up to the present been recorded from Psittaciformes, and the major points in which they differ from the new species described above are indicated by an asterisk. It will be noted that the species *microscolecina* and *psittacea* are closely related to *maplestonei*, n. sp., and also that the species *aruensis* differs principally in having the suckers unarmed. It appears desirable to call attention to the fact that, as the spines on the suckers are deciduous, it is not always safe to presume their absence, especially in gravid worms, unless several heads are available for examination.

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